State of Washington
Department of Ecology

STATE WATER PROGRAM

WASHINGTON STATE WATER PROGRAM

Columbia River

Instream Resource Protection Program

(Program Document, Environmental Impact Statement, and Proposed Regulation)

State of Washington **Department of Ecology**

June 1980

Columbia River Instream Resource Protection Program
Final Program Document

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Abbreviations Used In This Document

Agencies

BPA	Bonneville Power Administration
COE	U.S. Army Corps of Engineers (also USCE)
COFO	Committee on Fisheries Operations
CRFC	Columbia River Fisheries Council
DOE	Washington Department of Ecology (also WDE)
FERC	Federal Energy Regulatory Commission
PNRBC	Pacific Northwest River Basins Commission
PNRC	Pacific Northwest Regional Commission
PUD	Public Utility District (e.g. Chelan, Douglas, and Grant PUDs)
USBR	U.S. Bureau of Reclamation, now Water and Power Resources Service (WPRS)
WDF	Washington Department of Fisheries
WDG	Washington Department of Game
WEC	Washington Environmental Council
WPRS	Water and Power Resources Service

Other Abbreviations

cfs	cubic feet per second
CR&T	Columbia River and Tributaries Study (COE)
CRIRPP	Columbia River Instream Resources Protection Program
EIS	Environmental Impact Statement
kW, kWH	Kilowatt, kilowatt-hour
MW, MWH	megawatt, megawatt-hour
maf, MAF	million acre feet
RCW	Revised Code of Washington
WAC	Washington Administrative Code

I. SUMMARY AND RECOMMENDATIONS

The Department of Ecology has the responsibility of managing the water resources of the State of Washington (Chapter 90.54 RCW). The purpose of the Columbia River Instream Resource Protection Program is to establish the state's policies "for insuring the future viability of instream resource values of the main stem of the Columbia River . . ., including fish, wildlife, recreation, aesthetics, navigation, and hydropower resource values" (WAC 173-531-060). The Department of Ecology is undertaking this project with full knowledge of the limitations of the State of Washington. It realizes that management of the Columbia River involves other states, many federal agencies, and Canada. This program addresses the main stem of the Columbia River. The main stem of the Snake River is not included in this program but will be dealt with later by the Department of Ecology.

During years of below average runoff, there is not sufficient water in the Columbia Basin to serve all demands simultaneously. Therefore, management of the Columbia River to the greatest benefit of its users is a matter of delicate balance between fish and wildlife, power, irrigation, navigation, municipal and industrial water supply, recreation, flood control, and other uses.

The Department of Ecology, as a multi-objective agency, must consider all water uses in developing its programs. In this program, the department has been concerned with the development of recommendations that will result in a reasonable balance among the various uses of the Columbia River. In doing so, the department has gathered information from the fish and wildlife interests, the power operators, irrigators, and other user groups, and has made every effort to evaluate the information in reaching the program recommendations. It is recognized that the establishment of instream flows on the Columbia River will be a constraint on some of the more traditional uses of the Columbia River – especially hydroelectric power production. Nevertheless, the department believes that there is a need for more balanced use of the resource. The resulting program, in the department's judgment, provides a better balance among the uses than currently exists.

In this effort, the Department of Ecology is following the direction provided in the Water Resources Act of 1971, Chapter 90.54 RCW, which states "proper utilization of the water resources of this state is necessary to the promotion of public health and the economic well-being of the state and the preservation of its natural resources and aesthetic values" and that the state shall "insure that waters of the state are protected and fully utilized for the greatest benefit to the people of the State of Washington . . ." (RCW 94.54.010). A balanced use of the Columbia River will provide the greatest mix of economic and social benefits to the people of Washington and the Pacific Northwest. The Columbia River Instream Resource Protection Program's recommendations are aimed at achieving this balance.

The specific requirement to develop this program to protect instream resources in the Columbia River is contained in WAC 173-531-060 pursuant to Chapter 90.54 RCW. The need for stream flow preservation and protection is recognized by most of the Columbia River water users. However, because of the different priorities of use preferred by the users, no single mutually agreeable flows have been established. The department's program is designed to provide flows that are a reasonable compromise between uses and will still provide flows for planning and regulation in the future. In order to assess the alternatives and, develop flow recommendations, the department worked with user groups, environmental groups, and interested individuals to develop goals and objectives and several alternative programs.

To be consistent and compatible with regional efforts, the goals and objectives for this program are based on those set forth by the Pacific Northwest River Basins Commission in Water – Today and Tomorrow: A Pacific Northwest Regional Program for Water and Related Resources, Volume II, June 1979. As a member of the Pacific Northwest River Basins Commission, Washington State participated in the initial drafting of these goals and objectives. The goals and objectives for this program are shown in Table 1 and while not identical to those of the Commission's program do largely reflect the Commission's regionally developed goals and objectives.

The Goals and Objectives were drafted in October 1978 to provide conceptual guidance for the development and evaluation of alternative instream resource protection programs. The left column includes the general program objectives. The middle column presents the quantified objectives. For example, when possible, the desired levels of production or use have been identified for the various objectives. In turn, water management criteria and standards were identified in the right-hand column. These generally represent measures of, or conditions on, the way in which the Columbia River is, or could be, managed to achieve the identified objectives. These involve four principal parameters or groups of parameters; i.e., flow, volume, reservoir pool level, and water quality.

In developing the recommended program that is discussed in Section V of this document, the Department of Ecology examined several alternative programs. These alternative programs are summarized in Section IV of this document and are discussed in more detail in Section IV of the Environmental Impact Statement.

The alternative programs, including the recommended program, include a number of separate management elements related to Columbia River management. These resource management elements are shown in Table 3 which also includes an indication of (1) those elements over which the Department of Ecology has direct control; (2) those over which the Department of Ecology has some influence; and (3) those that are outside the authority or influence of the Department of Ecology.

In selecting the recommended program, the department has been limited to consideration of those management elements over which it has authority or influence. In the formulation of this program, the department made a policy decision that a degree of protection for instream resources would be treated as a higher priority than the production of nonfirm hydroelectric power. This policy arose primarily as a result of the fact that fish runs have declined substantially and selected species are being considered for classification as endangered or

threatened species under the Endangered Species Act of 1973, as amended. A discussion of all of the elements is included in the Environmental Impact Statement in Section IV, Management Options and Impacts.

Summary of Recommendations

The following is a brief summary of the recommendations included in this document. The major elements of the recommended program are:

1. Existing water rights are not affected by this program.

2. Establish minimum average daily flows by administrative regulation. The proposed flows include a provision for reduction during low water years.

3. Establish minimum instantaneous flows by administrative regulation. The proposed minimum flows include a provision for reduction during low water years.

4. Establish conservation and efficiency fundamentals by administrative regulation to guide the department in its effort to insure that the state's water resource be conserved.

5. Provide a volume of water for fish and wildlife benefits by negotiation. The use of this volume of water is to be determined by the system operators and the fish and wildlife interests. (The department's regulation does not include specific recommendations related to spill.)

6. For federal projects: seek authorization language to include fish and wildlife purposes.

7. For nonfederal projects: intervene in FERC licensing proceedings to seek flow provisions.

8. Encourage intensive management of the system for all uses, specifically including fish and wildlife.

9. Make commitment to consider specific recommendations regarding reservoir fluctuation limits when information becomes available.

The waters associated with the second half of the Columbia Basin Irrigation Project are excluded from the provisions of this program.

The Recommended Program is discussed in more detail in Section V of this document which includes a discussion of the recommended implementation strategy. Although implementation of portions of the program may be difficult, the department views this program as an excellent opportunity to clearly present the State of Washington's position regarding management of the Columbia River's resources.

Table 1. Columbia River Instream Resources Protection Program

GOALS AND OBJECTIVES

Regional Goal: To maintain or enhance the quality of life in the Pacific Northwest

Basic elements of "quality of life" are (in no order of priority):

- Economic well-being
- Environmental quality
- Social well-being

General Water Management Objectives: [1]	Quantification Water Management Objectives	Actual of Potential Water Management Criteria
Fish and Wildlife Restore, protect, and enhance fish and wildlife resources, and habitat so as to maintain, or increase healthy population levels and maintain genetic and species diversity for commercial, recreational, and ecological purposes.	Anadromous Fish Attain the following natural end artificial production and escapement above Bonneville Dams (See table 2 for more detail.) Smolt Production* Present / Objective Wild 18.882,60 / 36,090.000 Hatchery 61,398,000 / 64,398,000 Total 83,280,000 / 100,488,000 Planned Mitigation Programs 42,580,000 Total 243,556,500 *figures relate to Columbia River and Snake River stocks of Chinook, Sockeye, and Coho. Sources: Washington State Department of Fisheries by memoranda from Tom Meekin (WW) to Jim Bucknell (DOE) dated February 20, 1979. Resident Fish [2] Wildlife Protect existing quantities, distribution, and composition of riparian, littoral, and island habitats and associated vegetation and wildlife. Where feasible, restore wildlife habitats lost to development. (Additional date needed to quantify.) Where feasible, enhance wildlife resources by improving existing habitats or creating new habitats. (Additional data needed to quantify.)	For all objectives except electric energy, irrigation, municipal and industrial water supply, and flood damage reduction: Minimum instream flows. For all objectives except navigation, electric energy, and flood damage reduction: All Columbia River waters shall meet or exceed the State of Washington Class A water quality criteria. This will satisfy the federal Clean Water Act water quality goal of "fishable, swimmable" waters by 1983). The Columbia River New Grand Coulee Dam stall meet or exceed Class AA criteria. Class A criteria include: Total Dissolved Gas <110% of Saturation Turbidity <5 NTU or 10% increase, over background pH 6.5 - 8.5 Dissolved Oxygen >8.0 mg/l. >90% Saturation Fecal coliform median <100 organisms/100 ml no more than 10% of samples exceeding 200 organisms/100 ml Temperature (special conditions apply) <20°C Fish Spill requirement, artificial transportation, or turbine bypass system at dams. Additional storage dedicated to fish.
Recreation Provide sufficient water-related (including wildlife-oriented) outdoor recreation opportunities to fulfill desires for high-quality experiences on a sustained basis.	Recreation Provide opportunities for the following levels of recreational use: Activity Occasions[3] Reach / Actual 1973 / Estimated 2000 Lower Columbia 10,011,700 / 90,396,500 Upper Columbia 4,026,620 / 37,644,000 Lower Snake/Clearwater 746,527 / 19,668.000 The above recreational use is distributed as follows among the major activity groups: [4] Activity / Percent of Total Use (%) Sightseeing 46 Swimming 24	Wildlife and Recreation Maximum end minim pool elevations. Maximum pool fluctuation rates (flexibility by month and/or time of day). Aesthetic Values Spill requirement at Grand Coulee Dam – 8,000 cfs for 4 hours per day. (Seasonal? - Pro-ratable during low flow conditions?)

General Water Management Objectives: [1/]	Quantification Water Management Objectives	Actual of Potential Water Management Criteria
	Camping 9 Picnicking 7 Boating 5 Fishing 5 Hunting 2 Water Skiing 2	
Natural and Cultural Environment Restore, protect, or enhance those water, land, cultural and other environmental features including aesthetic volume which are unique or otherwise valuable to society.	Natural and Cultural Environment (See fish and wildlife and recreation above.)	
Navigation Provide for safe, convenient, and efficient commercial navigation and recreational boating.	Navigation Provide capacity to support the following levels of navigation activity: At Bonneville 1975 (sct.) 2000 Commercial Traffic (1,000 T) 5,200 [5/] 10,200 (1990)[6/] Recreation Traffic (vessels) 813 [7/] ?	Navigation – Currant velocity. – Requirements for lockage water. – Minimum depth (min. pool elevation).
Electric Energy Provide a dependable supply of electric energy from a mix of practical generating source, sufficient to meet regional needs for electric energy that reflect the maximum feasible implementation of conservation potentials and minimum environmental impact.	Electric Energy Fire Energy Load. Total Energy Load Peak Load. Probability of meeting firm loads. Probability of meeting total loads.	
Flood Damage Reduction Reduce flood losses to life and property.	Flood Damage Reduction Hold flood flows below 600,000 cfs at The Dallas.	Flood Damage Reduction Storage by river reach by time period.
Irrigation Maintain or achieve a level of irrigated agriculture which in conjunction with non-irrigated agriculture will utilize state production advantages in helping to maintain, or increase if practical, the state's present share of agricultural products markets.	Irrigation Irrigated area by subbasin/river teach.	Irrigation Diversion/depletion by river reach.
Municipal and Industrial Water Supply Provide adequate and safe water supplies for human consumption.	Municipal and Industrial Water Supply Population by subbasin/river reach. Employment by subbasin/river reach.	Municipal and Industrial Water Supply Diversions/depletion by river reach.

Table 1 (Continued)

BIBLIOGRAPHY

1. Columbia River Water Management Group, Columbia River Water Management Report for Water Year 1975, January 1976.

2. Memorandum dated 2/20/78 (sic; 79) from Tom Meekin (WDF) to Jim Bucknell (DOE).

3. Pacific Northwest River Basins Commission, Water - Today and Tomorrow: A Pacific Northwest Regional Program for Water and Related Resource. Volume II - The Region. (Commission Field Level Review Draft.) 1978.

4. Pacific Northwest River Basins Commission, Power Planning Committee. Seasonality of River Use - Columbia and Lower Snake Rivers. (CRT 15). December 1975.

5. U. S. Army Corps of Engineers, North Pacific Division. Columbia River and Tributaries Review Study – Base System Description for Mid-1980's. (CRT 35). November 1977.

6. U.S. Army Corps of Engineers, North Pacific Division. Columbia River and Tributaries Review Study - Planning Issues (CRT 27). February 1976.

FOOTNOTES

1/ Adapted from (3), Chapter II.

2/ To be supplied by Washington Department of Game.

3/ An activity occasion is defined as one person participating in one recreation activity during one day. See (5), p. 16. Also see (4) for activity occasion data by river reach and activity for 1969-1971 (average).

4/ See (5), p. 16.

5/ See (1), p. 63.

6/ See (6), p. II-8.

7/ See (4), p. 7.

Table 2
Adult and Juvenile Salmon Production above Bonneville Dam

	Adult Production (Catch plus Escapement)			Adult Escapement		Wild Smolt Production	
	Present Time	W/Present Trend	W/Enhance-ment	Present	Goal	Present	Goal
Snake River							
Chinook 1/	109,000	75,000	367,000	30,000 c/	121,000	5,172,400	20,860,000
Sockeye 2/ Coho	1,000	0	10,000 a/	<1,000	5,000	36,500	182,500
3/	5,000	0	30,000 b/	<1,000	5,000	20,000	100,000
Columbia River							
Chinook 4/	<500,000 d/	300,000	>500,000	<100,000 f/	>100,000	11,628,000	11,628,000
Sockeye 2/ Coho	80,000	60,000	150,000	50,000	80,000	1,825,000	2,920,000
3/	< 80,000 e/	> 80,000	>100,000	< 10,000	20,000	200,000	400,000
Totals							
Chinook Sockeye	609,000	375,000	867,000	130,000	221,000	16,800,400	32,488,000
Coho	81,000	60,000	160,000	51,000	85,000	1,861,500	3,102,500
	85,000	80,000	130,000	11,000	25,000	220,000	500,000
Totals	775,000	515,000	1,157,000	192,000	331,000	18,881,900	36,090,500

Hatchery Migrants Released above Bonneville Dam

Species	Present (1977) Number of Migrants		Objective
Spring Chinook	16,833,000		
Summer Chinook	1,570,000		
Fall Chinook	35,806,000		
Coho	10,189,000		
Sockeye	0		
Total Hatchery Smolts	64,398,000		64,398,000
Total Wild Smolts	18,881,900		36,090,500
Present Total Smolts	83,279,900	Production Goal	100,488,500
		Planned Mitigation Programs	42,58.0,000
		Totals	143,068,500

1/ Average survival of spring (0.67%) and summer (0.51%) Chinook of 0.58%.

2/ Average survival of 2.74%.

3/ Average survival of 5.0% to Columbia River hatchery.

4/ Average survival of spring (0.67%), summer (0.51%), and fall (1.4%) chinook of 0.86%.

a/ Production from 5000-fish escapement into Redfish Lake with catch : escapement ration of 6:1.

b/ Production from 5000-fish escapement into Snake River with catch : escapement ratio of 6:1.

c/ After sport end Indian catch in Snake River drainage, escapement goal equal to enhanced fish production a catch escapement ratios of spring Chinook 3:1, summer Chinook 0.5:1, fall Chinook 4:1. Assumes full use of Clearwater River drainage.

d/ Based on catch : escapement ratios; fall Chinook 6:1, spring Chinook and summer Chinook 2:1.

e/ Based on 7:1 catch : escapement ratio.

f/ Escapements of about 50,000 fall Chinook, 25,000 spring Chinook, and 10,000 summer Chinook.

Source: Washington State Department of Fisheries by memorandum from Tom Meekin (WOF) to Jim Bucknell (DOE) dated February 20, 1979.

According to the Washington Department of Fisheries, the mitigation objective of 42,580,000 smolts was based on mitigation programs that have been planned and are being negotiated or are under construction. These programs include the Middle Columbia River PUD mitigation, the Lower Snake River mitigation, the Similkameen River mitigation and the Yakima River mitigation. The additional Idaho Power mitigation program was being negotiated through FERC. The Grand Coulee Phase II

mitigation program of 39,000,000 Chinook smolts and an determined number of sockeye smolts was not included since definite plans as to the location of this mitigation have not been made. The Washington Department of Fisheries desires this mitigation to take place either immediately above or below Bonneville Dam to prevent excessive river mortality. Other fisheries agencies believe that this mitigation should take place in the upper rivers. Eventually there will be an effort to obtain mitigation for the four lower Columbia River Corps of Engineers dams. As yet, plans or negotiations have not been initiated to obtain this mitigation.

Table 3
Resource Management Elements
Columbia River Instream Resource Protection Program

This table identifies major resource management elements associated with the Instream Resource Protection Program objectives. This table further identifies the Washington Department of Ecology's (DOE) role in the implementation of management elements. Items in CAPS denote the principal focus of the Instream Resource Protection Program.

Resource Management Elements	Implementation		
	DOE (direct)1/	DOE (influence)	Other
ANADROMOUS FISH			
HABITAT MANAGEMENT			
BASE FLOW (CHAPTER 90.54 RCW)	X		
MINIMUM FLOW (CHAPTER 90.22 RCW)	X		
CONSERVATION PROVISION ON WATER RIGHTS	X		
REALLOCATION OF STORAGE		X	
ADDITIONAL STORAGE		X	*
CONTROL OF POOL FLUCTUATION		X	*
Water Quality Management	*		
Shoreline Management		*	*
Designation of Hanford Reach Under Wild and Scenic River Act			*
Establishment of Speed Limits for Large Ships Below Bonneville			*
Tributary Habitat Management		*	*
FISH PASSAGE			
Fish Ladder Modifications			*
Fish Screens and Bypass Systems			*
Spillway Deflectors			*
Fish Transportation (Truck or Barge)			*
SPILL FOR FISH		X	*
Harvest Management			
Marine Harvest Management			*
Freshwater Harvest Management			*
Artificial Production			
Hatcheries			*
Spawning Channels			*
RESIDENT FISH AND WILDLIFE			
HABITAT MANAGEMENT			
PROVISION/MAINTENANCE OF INSTREAM FLOW	X		
CONTROL OF POOL FLUCTUATION		X	*
Water Quality Management	*		
Shoreline Management		*	*
Tributary Habitat Management		*	*
Harvest Management			*
RECREATION			
(See Anadromous and Resident Fish and Wildlife above.)			
NAVIGATION			
Control of Pool Fluctuation		X	*
Ben Franklin Lock and Dam		*	*

X Principal focus of the Columbia River Instream Resource Protection Program.
* Other implementation authority.
1/ DOE's direct authority is limited to actions in Washington State.

II. BACKGROUND

As early as 1915, the State of Washington's water resources policy development activities related to the Columbia River had begun. More recent accomplishments include resolution of the status of future state water appropriations with respect to federally appropriated waters of Lake Roosevelt through an agreement between the state and the Water and Power Resources Service (WPRS). The agreement allows a blanket release by WPRS for each state appropriation permit for less than ten cubic feet per second.

In 1974, the department developed a draft management program for the Lower Snake River. This program set forth an allocation of water for instream flow needs, consumptive uses, and hydropower generation. The program recommended that future established consumptive uses be subject to a minimum instantaneous instream flow requirement of 12,000 cubic feet per second and that hydropower operations be subject to a minimum instantaneous instream flow level of 20,000 cubic feet per second. These flows are monitored near Clarkston at U.S.G.S. Gage No. 13-3435 at River Mile 132.9, below the confluence of the Clearwater River. Washington's proposed allocation has not been adopted in a management regulation. However, water rights subsequently issued by the department have been conditioned with the instream flow provisions of 12,000 cfs for a preservation flow and 2,000 cfs for a firm supply for irrigation and allied consumptive uses. Reevaluation of the proposed allocation is planned as a future activity.

Beginning in 1975, the department developed a water resources management program for the John Day/McNary reach of the Columbia River. High interest in irrigation development, proposed expansion of generation capacity at McNary Dam, problems of preserving instream resource viability, and the controlling nature of this reach within the entire system created the priority for a policy defining the state's interest in this reach.

A public workshop on the allocation and use of water resources of the John Day/McNary reach was sponsored in April 1976 by the Department of Ecology and the Pacific Northwest River Basins Commission. This was followed by a public meeting later in the same year.

Early in 1978, the department's advisory body, the Washington State Ecological Commission, sponsored a series of five public meetings on the proposed management program. Substantial input in the form of written correspondence was also received. The resulting recommended program was adopted by regulation (WAC 173-531) on August 8, 1978, reserving 1.36 million acre-feet annually for irrigation, 26,000 acre-feet for public water supply, and committing the department to "develop a program for insuring the future viability of instream resource values of the main stem of the Columbia River and the main stem of the Snake River, including fish, wildlife, recreation, aesthetics, navigation, and hydropower resource values." (WAC 173-531-060(1)). This document addresses instream resource protection on the main stem Columbia River. It is expected that later documents will re-address instream needs on the Snake River.

Table 4 provides a brief chronology of the major activities of the State of Washington regarding management of the waters of the Columbia River.

Throughout the development of this program, the department has relied heavily on the provision of information by other agencies and interests involved in the Columbia River. For example, the following agencies or groups have been involved in the CRIRPP program.

Washington Department of Fisheries
Washington Department of Game
Washington Department of Social and Health Services
Washington Department of Natural Resources
National Marine Fisheries Service
U.S. Fish and Wildlife Service
Heritage Conservation and Recreation Service
Water and Power Resources Service (formerly U.S. Bureau of Reclamation)
U.S. Army Corps of Engineers
Bonneville Power Administration
Federal Energy Regulatory Commission
Bureau of Indian Affairs
U.S. Environmental Protection Agency
Columbia River Intertribal Fish Commission
Columbia River Fisheries Council
Pacific Northwest River Basins Commission
Oregon Department of Fish and Wildlife
Idaho Department of Water Resources
The mid-Columbia PUDs (Chelan, Douglas, and Grant Counties)
Washington Public Power Supply System
Washington Environmental Council
Mid-Columbia Archaeological Society
Tahoma Audubon Society
Washington Kayak Club
State Association of Irrigation Districts

Representatives of many of these groups attended monthly meetings during the formulation of this program. Input received at these meetings helped to shape the department's recommendations. Since the publication of the draft reports in March 1979, detailed comments from more than 30 agencies and individuals have been received by the department. Many of these comments have resulted in revision and/or the inclusion of new material in this document. Copies of the comments received by the department are available upon request.

Table 4
Major Activities of the State of Washington Regarding the Columbia River*

1891 – Legislature enacts water right notice requirement
1915 – Columbia River Fish Compact (WA-OR)(75.40.010 RCW)
1917 – Surface Water Code (90.03 RCW)
1919 – Reclamation Act (89.16 RCW) and Land Settlement Act
– $100,000 appropriation for Reclamation Revolving Fund
– Columbia River Investigation – Columbia Basin Survey Commission – $100,000

1921 – $50,000 appropriation to continue survey of Columbia Basin
1925 – Columbia River Interstate Compact considered
1929 – Power License Fees (90.16.050 RCW)
1930-33– Rock Island Dam constructed (Washington Electric Company, now Chelan Co. PUD)
1933 – Columbia Basin Commission created (43.49 RCW) - $377,000 allotted to finance preliminary engineering work
1933-38 – Bonneville Dam constructed (USCE)
1933-41 – Grand Coulee Dam constructed (USBR)
1935 – Grand Coulee Dam Project authorized by Congress
1937 – Columbia Basin Commission ceases operation due to lack of funds
1943 – Columbia Basin Project Act passed by Congress
– Columbia Basin Commission re-created
1947 – Pacific Marine Fisheries Compact (75.40.030 RCW)
1947-54 – McNary Dam constructed
1949 – Columbia River Fish Sanctuary Act (75.20 RCW)
1950 – Columbia River Interstate Compact Commission formed (43.57 RCW)
1950-55 – Chief Joseph Dam constructed (USCE)
1952-57 – The Dalles Dam constructed (USCE)
1955-65 – Proposed Columbia River Interstate Compact fails to achieve ratification in the legislatures of Washington and Oregon
1956-59 – Priest Rapids Dam constructed (Grant Co. PUD)
1956-61 – Rocky Reach Dam constructed (Chelan Co. PUD)
1957-61 – Ice Harbor Dam (Snake R.) constructed (USCE)
1958-68 – John Day Dam constructed (USCE)
1959 – Columbia River Gorge Commission created (43.97 RCW)
1959-63 – Wanapum Dam constructed (Grant Co. PUD)
1962-69 – Lower Monumental Dam (Snake R.) constructed (USCE)
1963-67 – Wells Dam constructed (Douglas Co. PUD)
1963-70 – Little Goose Darn (Snake R.) constructed (USCE)
1965-71 – Dworshak Dam constructed (USCE)
1964-73 – Columbia River Treaty projects (Duncan, Arrow, Mica; Libby) constructed (BC Hydro; USCE)
1965-75 – Lower Granite Dam (Snake R.) constructed (USCE)
1967-69 – Water Rights Claims Registration Act (90.14 RCW)
1969 – Minimum Flows and Water Levels Act (90.22 RCW)
– State/Bureau of Reclamation agreement releasing appropriations of 10 cfs or less from Lake Roosevelt
1971 – Water Resources Act of 1971 (90.54 RCW)
1972 – Referendum 27 – Washington Future Bonds – $25 million for agricultural water supply
1974 – Snake River Policy proposed
1976 – $15 million appropriation for Second Bacon Siphon and Tunnel (from Referendum 27)
– Term permit regulation for significant appropriations (WAC 173-596)
1977 – Drought – $33 million appropriation for emergency relief
– Initiative 59 – Family Farm Water Act (90.66 RCW)
1978 – John Day/McNary Basin Management Program (WAC 173-531)
1979 – Columbia River Instream Resources Protection Program

AGENCY RESPONSIBLE FOR ADMINISTRATION OF WATER RIGHTS

1891 – County Recorder
1917 – Office of State Hydraulic Engineer
1921 – Department of Conservation & Development
1957 – Department of Conservation
1967 – Department of Water Resources
1970 – Department of Ecology

* *Items in italics indicate construction dates for the power dams on the system.*

III. THE COLUMBIA RIVER SYSTEM

The Columbia River and its tributaries drain an area of approximately 259,000 square miles. Beginning at Columbia Lake in British Columbia, Canada, the river follows an indirect course to the Pacific Ocean on the Washington-Oregon border. Of the total drainage area, about 219,000 square miles are in the United States. Of these, about 47,900 square miles are in the State of Washington. (See Figure 1). From headwaters to mouth, the Columbia River is about 1,220 miles long. The distance from the mouth to the Canadian border is 745 river miles.

According to U.S. Geological Survey data, the average annual flow of the Columbia River at The Dalles, Oregon, is 194,600 cfs or 141,000,000 acre-feet per year. Of this flow, only about 41 million acre-feet (23 percent) originates in Washington State. The remaining flow (77 percent) is the result of inflow from the other states and Canada.

Because of the orographic[2/] precipitation that occurs along the west slope of the Coast Range and the Cascade Mountains, air masses reaching the Columbia Plateau east of the Cascades often absorb moisture, resulting in semiarid conditions. Average annual precipitation is less than 12 inches in parts of the Columbia and Snake River plateaus. Such figures can be misleading because of highly variable seasonal precipitation patterns. As a rule, much of the Columbia Basin area experiences a small percentage of the total annual precipitation during the spring and summer. As a result, the period with the least precipitation, highest temperatures, and most evaporation often coincides with the period having the peak water demand for irrigation, food processing, streamflow maintenance, and water-based recreation. With the exception of range and forest lands, dryland wheat, hay, and pea-growing areas, nearly the entire Columbia Basin relies on irrigation for crop production and domestic horticulture.[3/]

The waters of the Columbia River are vital to a number of uses: fish and wildlife, recreation, aesthetics, navigation, power, flood control, irrigation, waste assimilation, and rural domestic, municipal, and industrial water supply. There are conflicts between some of these uses. This is becoming increasingly evident as the system's full power generation capacity is reached and as other demands for the water resources increase. In order for this document to adequately discuss a program for managing these waters to insure protection of instream resources, it is necessary to briefly review the existing situation. For a discussion of related planning and management activities, see Appendix H and Appendix I in the EIS.

1/ U.S. Geological Survey, Water-Data Report, WA-75-1. Water Resources Data for Washington, Water Year 1975.

2/ Orographic precipitation: Rain which is caused by mountains standing in the path of moisture-laden air; this air is forced to rise and is thereby cooled. If sufficient water vapor is present, rain is deposited on the high ground. As a result of this phenomenon, mountains or hilly regions often receive a consistently higher rainfall than neighboring places located on low-lying ground.

3/ PNRBC Regional Program, Vol. II, p. 3-11.

Flood Damage Reduction*

Prior to the 1930's most water resource developments in the Pacific Northwest were constructed to serve single purposes such as power generation, irrigation, flood control, or municipal and industrial water supply. Between 1930 and 1940, construction of two major federal multiple-purpose projects was undertaken and completed. The Bonneville Project was built on the Lower Columbia River by the Corps of Engineers to provide electrical energy and slackwater navigation. The Grand Coulee Project was constructed by the Bureau of Reclamation to provide water for irrigation and power generation. The devastating flood of 1948 placed additional emphasis on flood control and on the utilization of storage for reduction of the flood peak. A significant part of the active storage of the system is usable for flood control on a forecast basis. Table 5 is a tabulation of maximum annual flood peak discharges in the Columbia River at The Dalles, Oregon, for the years 1949 through 1978 as computed without regulation and as observed. Damages prevented in the Lower Columbia and totals for the basin are also shown and represent the damage for the price and development level of the year of occurrence. At today's price and development level, the amounts would be much larger. The damage prevented by control of winter floods on tributary streams is not shown.

Operation of Grand Coulee and other Bureau of Reclamation projects, in the interest of flood control, was initiated in 1949 and the benefit resulting from reduction of the 1950 flood peak discharge from 823,000 to 744,000 cfs in the Lower Columbia was nearly $10 million.

Between 1950 and 1956, Hungry Horse, Albeni Falls, Palisades, and Lucky Peak projects were completed. In April, 1956, the runoff volume of the April-September period was forecasted to be in excess of 130 million acre-feet. Steps were taken to obtain as much vacant space as possible for storage of flood water. The computed unregulated peak discharge of 940,000 cfs was reduced to 823,000 cfs and the resulting damage prevented was $38 million in the entire basin with $25 million being in the Lower Columbia.

In 1964, the Columbia River Treaty between the United States and Canada was ratified and construction was started on Hugh Keenleyside, Duncan, and Mica projects in British Columbia, Canada, and Libby project on the Kootenai River in Montana. Between 1956 and 1971, Hugh Keenleyside, Duncan, Noxon, John Day, and Brownlee projects were added to the system. The Dworshak Project in Idaho and the Libby Project in Montana were under construction in 1972, and some of the storage in these two projects was used to reduce the 1972 flood peak. In 1973, McNaughton Lake behind the Mica project began filling, but 1973 was a low flow year so the storage was not needed for flood control. The next year, 1974, was one of the largest streamflow years since 1894; 11 million acre-feet of storage space was filled in McNaughton Lake and 25 million acre-feet were stored in Arrow Lakes, Lake Koocanusa (Libby Reservoir), Duncan Lake, Hungry Horse Reservoir, Flathead Lake, Franklin Delano Roosevelt

*Source: Columbia River Water Management Group, Columbia River Water Management Report for Water Year 1978, January 1979.

Figure 1. Columbia River Drainage Basin

Table 5
Effect of Reservoir Regulation on Flood Peaks Since 1949
Columbia River Basin

Year	Maximum Annual Flood Peak at The Dalles, Oregon (1,000 cfs)		Damage Prevented (Millions of Dollars)	
	Unregulated 1/	Observed 2/	Lower Columbia 3/	Total Columbia Basin 4/
1949	660	624	0.67	NA
1950	823	744	9.80	NA
1951	652	602	0.80	NA
1952	597	561	0.34	NA
1953	672	612	1.18	NA
1954	590	560	0.26	NA
1955	614	551	0.62	NA
1956	940	823	25.00	37.60
1957	820	705	6.60	11.11
1958	735	593	3.55	7.83
1959	642	555	0.88	2.60
1960	493	470	0.08	0.58
1961	789	699	6.50	7.50
1962	508	460	0.09	1.79
1963	481	437	0.03	0.65
1964	764	662	7.60	22.91
1965	669	520	1.44	7.81
1966	455	396	None	0.43
1967	781	622	14.21	20.80
1968	533	404	0.26	1.07
1969	628	449	2.61	5.51
1970	634	426	1.16	6.34
1971	740	557	8.49	25.73
1972	1,053	618	213.10	260.49
1973	402	221	0.00	0.52
1974	1,010	590	239.73	306.36
1975	669	423	9.41	40.97
1976	637	419	15.65	43.08
1977	276	183	0.00	0.00
1978	565	313	3.11	31.48

NA - Not Available.

1/ Unregulated discharge 1949 to 1955 from House Document No. 403, 87th Congress, 2nd Session. 1956 to 1976 from Columbia River Water Management Group Annual Reports.

2/ Observed discharges from U.S. Geological Survey Water Supply papers.

3/ Damages are for the Columbia River below McNary Dam. Damages prevented for 1949 to 1955 are from House Document 403, and 1956 to 1976 are from Columbia River Water Management Group Annual Reports.

4/ Damages are for the Columbia River and selected major tributaries. Totals are those shown in Columbia River Water Management Group Annual Reports and represent damages prevented by major projects during the spring and summer high runoff periods. Winter flood damage in the Willamette and other tributaries and damage prevented by levees and channel improvements are not included. Damage prevented in Canada is not included.

Source: Columbia River Water Management Group, Columbia River Water Management Report for Water Year 1978, January 1979.

Lake, Brownlee, and Dworshak Reservoirs. The unregulated peak discharge on the Columbia River at The Dalles would have been 1,010,000 cfs on June 21, 1974 but the actual peak was reduced to 590,000 cfs. The benefit of this reduction in 1974 was $240 million in the Lower Columbia and $306 million for the entire basin. Runoff has been above average in three of the recent four years, 1975, 1976, and 1978, but peak discharges have been regulated to nondamaging magnitude or less.

Hydroelectric Power

The Columbia River Basin is well suited to hydroelectric power generation. There are 79 hydropower projects with capacity of 15 MW or more in the Columbia Basin, including the Canadian portion. Figure 2 shows projects with a capacity of 100 MW or more or an active storage capacity of one million acre-feet or more. Eleven of these are located on the main stem of the Columbia River in or bordering Washington State, with an additional four projects located on the lower Snake River in Washington (see figures 3 and 4 and Table 6).

Hydroelectric power plays an important role in the economic well-being of the Pacific Northwest. It is the primary energy source to meet industrial and residential demand. Hydroelectric power generation presently provides about 80 percent of the region's electric power. Most of the remaining 20 percent is generated at thermal electric plants. The portion of the load to be carried by renewable resources will depend on various economic incentives and technological improvements. Thermal-electric power generation is expected to play a much larger future role in regional power production.

The region's installed hydroelectric generating capacity (nameplate) on December 31, 1978, was approximately 26,700 megawatts (MW); an additional 3,900 MW were under construction. Hydroelectric capacity represents about 80 percent of total electric generating capacity in the region.

More than half of the region's existing hydroelectric capacity (17,174 MW) is installed at 31 federal multipurpose projects; the remaining 9,958 MW are at the 114 nonfederal projects.

As of December 31, 1978, there were about 4,620 MW of installed capacity at fossil-fueled thermal electric plants, including the region's share from two plants outside the region; one at Colstrip, Montana, and the other at Rock Springs, Wyoming. There were 1,030 MW of fossil-fueled generation under construction.

The two nuclear-fired thermal plants (Hanford in Washington and Trojan in Oregon) produce 1,990 MW of electricity and there are an additional 6,090 MW under construction at Hanford and Satsop. With the exception of one 12 MW plant and six very small emergency plants (about 0.5 MW total), all thermal powerplants, either existing or under construction, are nonfederal.

Figure 2. Major Hydroelectric Power Projects of the Columbia River Basin

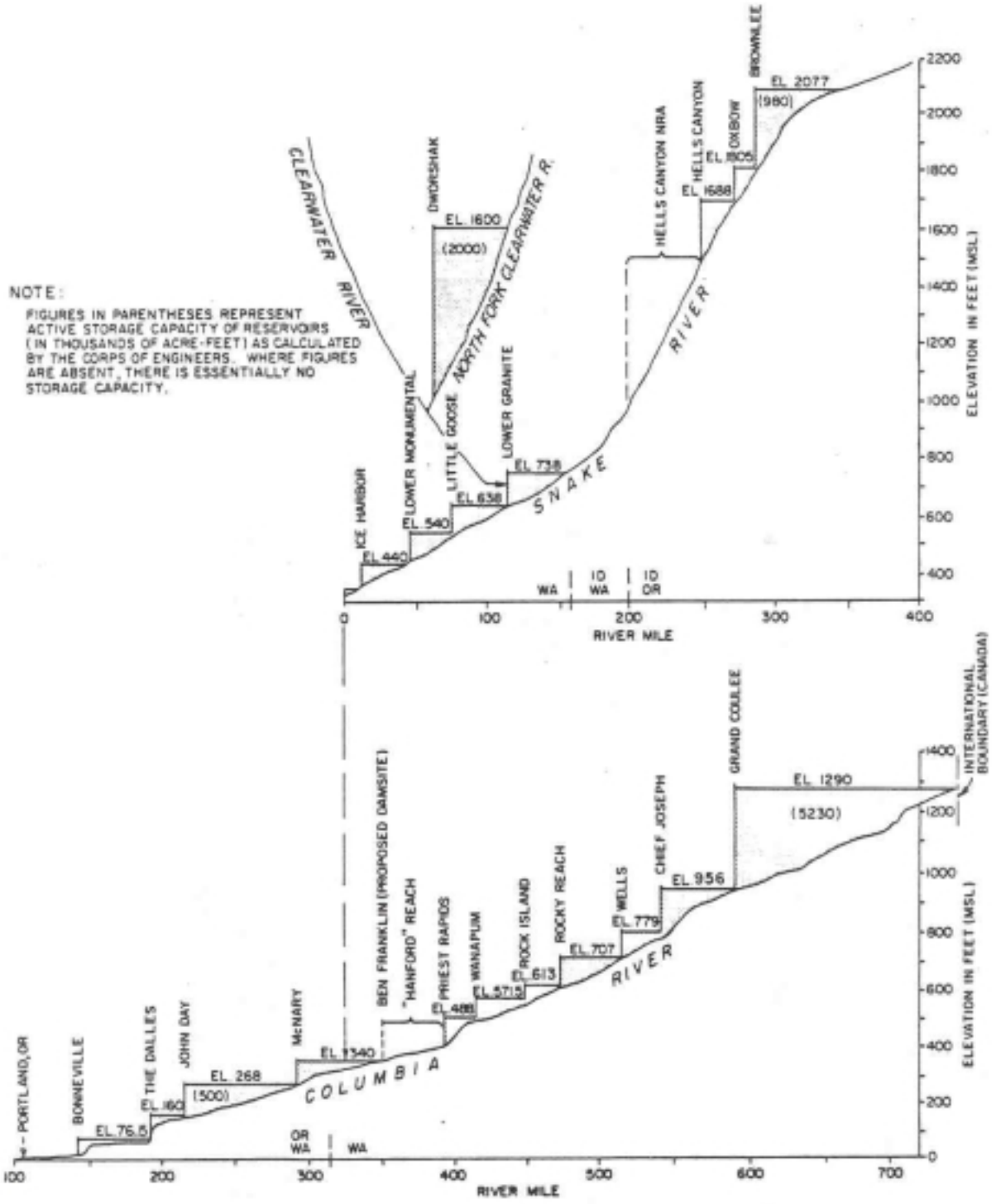


Figure 3. Profile of Columbia and Lower Snake River Projects

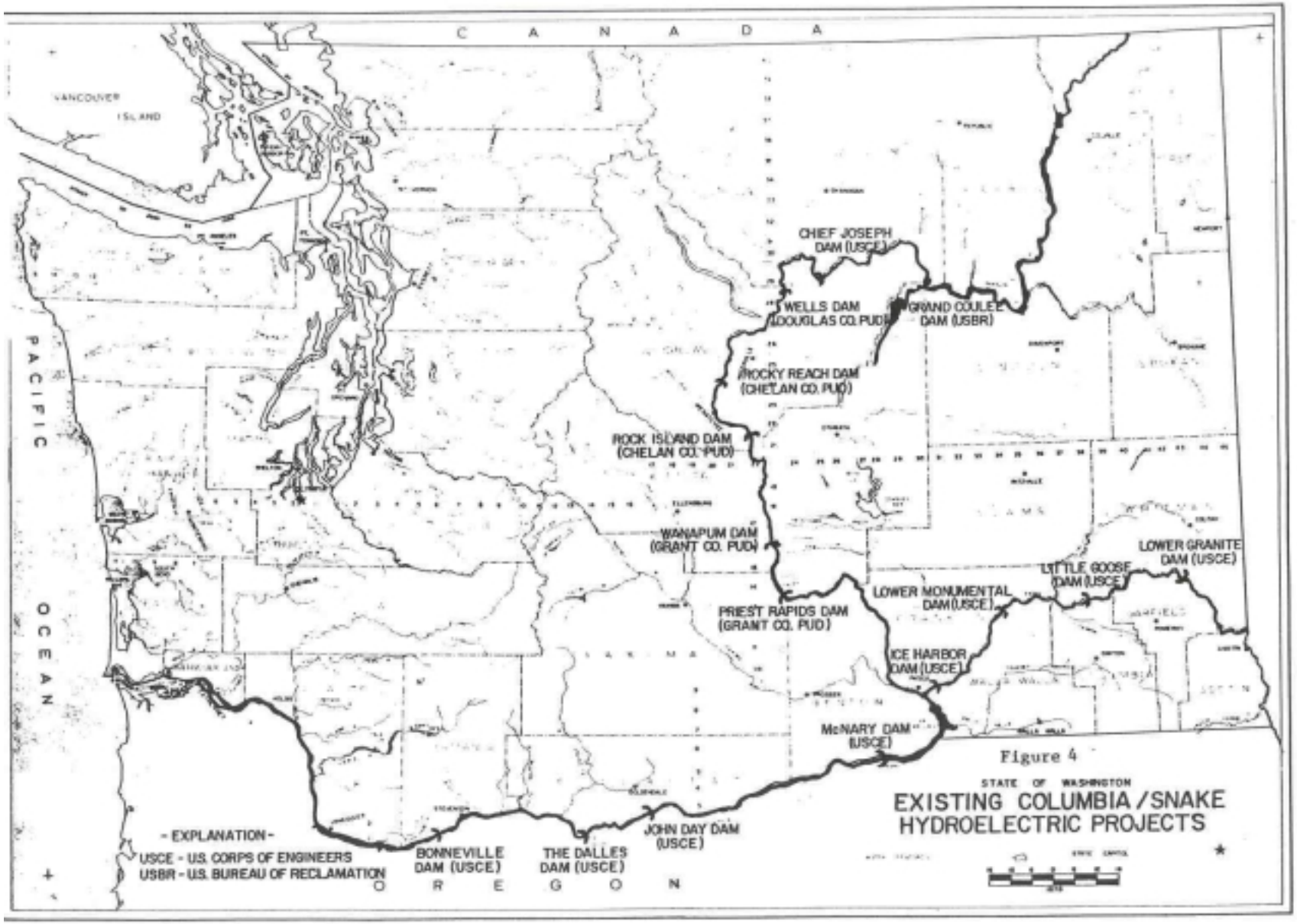


Figure 4 Existing Columbia /Snake Hydroelectric Projects

TABLE 6
Hydroelectric Power Projects In Washington State [1]

Columbia and Snake Rivers (mainstems only)
May 1980

Facility Name	Owner	Units	Powerhouse Hydraulic Capacity(1,000 cfs)	Nameplate Rating (megawatts)
Columbia R.				
Grand Coulee	WPRS	24	273	6,163
Chief Joseph	USCE	27	210	2,069
Wells Douglas	PUD	10	220	774
Rocky Reach	Chelan PUD	11	210	1,213
Rock Island	Chelan PUD	18	220	620
Wanapum	Grant PUD	10	183	831
Priest Rapids	Grant PUD	10	175	789
Snake R.				
Lower Granite	USCE	6	138	810
Little Goose	USCE	6	138	810
Lower Monumental	USCE	6	138	810
Ice Harbor	USCE	6	95	603
Columbia R.				
McNary	USCE	14	220	980
John Day	USCE	16	354	2,160
The Dalles	USCE	22	376	1,807
*Bonneville	USCE	10	136	518
			TOTAL	20,957

*This project has major additions under construction.

1/ Although the four lower Columbia projects are located on the Washington-Oregon border, all mainstem projects are fully considered in this program.

SOURCE: U.S. Army Corps of Engineers and Pacific Northwest Utilities Conference Committee.

Although the region's coal resources are estimated to total about 6.5 billion tons, only in Western Washington near Centralia is it being utilized in a thermal-electric generating plant. The Boardman (Carty) coal-fired plant, now under construction near Boardman, Oregon, will use coal brought in from Gillette, Wyoming.

No producing oil or gas fields exist, although considerable exploratory drilling has found small quantities of both. Plants using these fuels must rely on imports. Geothermal exploration is limited in the region although all the states have some potential. Several areas in Idaho, Montana, Oregon, and Washington are listed by the Geological Survey as "Known Geothermal Resources Areas" under the Geothermal Steam Act of 1970. The U.S. Department of Energy has an experimental geothermal development at the Raft River site in Idaho.

The Bonneville Power Administration (BPA) markets power from federal projects throughout the region. The BPA transmission grid interconnects all of the system plants except for five Bureau of Reclamation (USBR) projects in Idaho and one in Oregon, and one Bureau of Indian Affairs project in Montana; and BPA markets power from all the project except the USBR Green Springs project in Oregon. Most of the region's nonfederal marketing areas and transmission systems also are interconnected with the BPA grid under various power purchase or interchange agreements.

Power exchanges with areas outside the region benefit both the Pacific Northwest utilities and others with whom such exchanges are made. Intertie lines and power exchange agreements exist between Northwest and Southwest utilities; federal agencies; British Columbia and the United States; BPA and Montana Power; and Idaho and Utah. Table 7 illustrates some of the power exchanges occurring in the Western United States in 1974.*

*Portions of this section to this point are derived from Water – Today and Tomorrow (Volume II – The Region), by the Pacific Northwest River Basins Commission, June 1979.

Table 7
Electrical Energy Production and Consumption
Western United States
(1,000,000 KM-HR)

State	Electrical Consumption[1/]	Gross Production[1/]	Net Production[2/]	Net Imports	Net Exports	% Consumption Imported	% Production Exported
Arizona	20,280	20,532	17,863	2,417		11.9	
Alaska	1,624	1,860	1,618	6		0.4	
California	133,283	122,094	106,222	27,061		20.3	
Colorado	14,949	15,650	13,616	1,333		8.9	
Idaho	12,922	9,694	8,434	4,448		34.7	
Montana	9,169	11,055	9,618		449		4.7
Nevada	7,724	13,838	12,039		4,315		35.8
New Mexico	7,070	20,113	17,498		10,428		59.6
Oregon	30,646	35,293	30,705		59		0.2
Utah	7,201	4,038	3,513	3,688		51.2	
Washington	59,134	89,379	77,760		18,626		24.0
Wyoming	4,200	10,803	9,397		5,197		55.3
Total	308,202	354,349	308,283	38,993	39,074		

1/ "Electric Power Statistics" Federal Power Commission - 1974. (12 volumes).

2/ Net production averaged 87% of gross production for Region. Equal losses assumed for each state.

Source: Western States Water Council. Pacific Northwest River Basins Commission, Water - Today and Tomorrow. Volume II - The Region, June 1979.

Bonneville Power Administration's regional power revenues averaged approximately $260 million per year during 1974-1979. BPA's revenues are expected to increase substantially following the 88 percent rate increase implemented December 20, 1979.

Table 8 displays instantaneous and average daily minimum flows that, while not necessarily established by firm agreement, are generally used for power studies on the Pacific Northwest hydroelectric system and represent minimum flows based on factors such as hydraulic limitations of the projects, informal agreements, and requirements of Federal Energy Regulatory Commission (FERC) licenses. These flows essentially represent the existing situation.

The operating (as distinct from nameplate) capacity of the existing hydroelectric projects on the main stem Columbia and Snake rivers in Washington was approximately 20,500 megawatts as of January 1979. This figure will increase as the additions to projects noted in Table 6 come on line.

According to the 1979 West Group Forecast of Power Loads and Resources** for July 1979 through June 1990, the probability that resources will be insufficient to meet firm energy load varies between 11 and 28 percent for each year between 1979-80 and 1989-90. This forecast also indicates an 85 percent chance that resources will. Be insufficient to meet firm load during at least one occasion in this eleven-year period. These forecasts are based on loads that are assumed to increase at an average annual rate of 3.9 percent during this period. This figure is based on a summation of each utility's load estimates, as supported by an econometric load forecasting model. Implementation of the Department of Ecology's proposed minimum flows for the Columbia River would increase the West Group forecast probabilities to some degree while effective energy conservation (and voluntary curtailment during critical periods) could help minimize the percentages. According to the U.S. Fish and Wildlife Service, a BPA-funded study forecast that northwest energy consumption would increase by only 15 percent from 1974-1995 (a period twice as long as the West Group forecast) if cost-effective conservation and other energy efficiency programs are promptly carried out. (For a more detailed discussion of impacts of the department's proposal, see section V.B).

The establishment of instream flows as proposed in this program will decrease the power system operator's ability to produce peaking power and may also reduce their ability to generate firm power. The department's recommended program reflects a policy decision that a degree of protection for instream resources would be treated as a higher priority than the production of nonfirm hydroelectric power. This decision is based on the condition of the declining fish runs and the fact that several of the runs are being considered for inclusion on the endangered species list. Should this occur, the ability of future water users to withdraw water from the river could be curtailed with- severe economic implications for the entire Pacific Northwest region. This program is an attempt to provide some protection for the instream resources.

**Published by the Pacific Northwest Utilities Conference Committee, March 1979. The "West Group" area of the Northwest Power Pool includes all of Washington, most of Oregon, northern Idaho, western Montana, and portions of southern Idaho, northern California, Nevada, Utah, and Wyoming served by BPA or Pacific Power and Light Company.

TABLE 8
Existing Minimum Instream Flows
(cfs)

Dam	Instantaneous		Average Daily
	Dec-Feb	Mar-Nov	
Columbia River			
Grand Coulee	None	None	1/
Chief Joseph	"	"	1/
Wells	"	"	1/
Rocky Ranch	"	"	1/
Rock Island	"	"	1/
Wanapum	"	"	1/
Priest Rapids	36,000	36,000	36,000
Snake River			
Lower Granite	None	11,500	2/
Little Goose	"	"	2/
Lower Monumental	"	"	2/
Ice Harbor	None	9,500/7,5003/	2/
Columbia River			
McNary	12,500	50,000	2/
John Day	"	"	2/
The Dalles	"	"	2/
Bonneville	80,000	80,000	100,000

1/ 24-hour minimum discharge as required to assure 36,000 cfs below Priest Rapids.
2/ Minimum 24-hour mean discharge same as minimum instantaneous discharge.
3/ 9,500 cfs March-July; 7,500 cfs August-November.

SOURCE: U.S. Army Corps of Engineers, Base System Description for the Mid 1980's (CRT 35), November 1977, p. 3.

Irrigation

There were approximately 7.5 million acres of land under irrigation in the Columbia River Basin in 1973-74. Considerable potential exists for additional irrigation development. An increase of as much as four million acres in irrigation has been projected by the states by the year 2020. Additional water is expected to be used for supplemental irrigation of existing irrigated areas.

In 1975, approximately 1.5 million acres were irrigated in the Washington portion of the Columbia Basin. About 700,000 acres were irrigated directly from the Columbia or Snake rivers in Washington. State projections indicate that approximately 2.7 million acres are likely to be irrigated in the Columbia Drainage Basin in Washington by the year 2020, with commensurate increases in the area irrigated directly from the main stem Columbia/Snake rivers.

The Pacific Northwest state's irrigated farm products were valued at about $3 billion in 1977. Expanded irrigation development in the future could provide a substantial increase in farm commodity output. Adverse effects include loss of downstream power generation and power requirements for irrigation pumping, as well as some reduction of flows and entrainment of fish in irrigation diversions. Crop irrigation directly uses about 3 percent of the power regionally at the present time. That share is expected to go to about 2.7 percent in 1995.

TABLE 9
Effect of Depletions on Flow of the Columbia River at the Dalles

	A. Observed Flow[1/]	B. Estimated net depletions (Basin wide) 1970	1977	C. Estimated Undepleted Flow (A+B)	D. % Depletion (1977 level) based on undepleted flow (B_4 - C) x 100
	--million acre feet--				
Annual					
average [2/]	137	15		152	12
critical [3/]	87		18	105	17
April through September					
average [2/]	84	16		100	19
critical [3/]	39		19	58	33
August					
average [2/]	9.2	3.5		12.7	30
critical [3/]	5.8		3.8	9.6	40

1/ Observed flows include the effect of reservoir regulation; they are not adjusted for storage.

2/ Average values are for the 15-year period 1963-77 (Water Years).

3/ "Critical" values are for Water Year 1977.

4/ Value is for Water Year 1977.

Source: Columbia River Water Management Group and U.S. Geological Survey.

The effect of current irrigation development on flows of the Columbia River at The Dalles is shown in Table 9. While 1977 net depletions were only 12 percent of the 15-year average annual undepleted flow, estimated August 1977 net depletions were approximately 40 percent of the regulated, undepleted flows of that low flow month. The projected regional increase in irrigation would increase net depletions by roughly 7 million acre-feet by 2020. Percent depletions in 2020 would then be approximately 16 percent of the average annual undepleted flow or 52 percent of the regulated, undepleted August 1977 flow.

All instream uses, including power, fish, wildlife, recreation, navigation, and waste assimilation, will be affected by irrigation withdrawal to some extent as flows are reduced.

Fish

Anadromous Fish

Before man's development and use of the Columbia River, the river system yielded an estimated 30-40 million pounds of salmon and steelhead per year, according to the Columbia Basin Salmon and Steelhead Analysis by the Pacific Northwest Regional Commission. Recently, despite about $500 million spent on fish hatcheries, ladders, and spawning channels, the total annual salmon and steelhead yield is estimated by the National Marine Fisheries Service at about 20 million pounds. The estimated economic value of Columbia River-produced salmon and steelhead is now about $130 million annually. Early depletion of the fishery due to dam operation, over-fishing in the river system and subsequent over-fishing in the ocean, and irrigation diversions have severely limited the numbers of adult spawning fish returning.

The Washington Department of Fisheries reports that it is difficult to determine how much of the depletion of the fisheries stock was due to irrigation diversions. By the mid-1940's however, the majority of the major diversions and many of the minor diversions had been screened to prevent entrapment of juvenile fish and this no longer was a problem. By the late 40's and early 50's the upper river runs began to increase. This increase may have been the result of screened irrigation diversions and a slight decrease in the down river commercial fishing activities.

High dams on the Columbia and its tributaries posed the first migration barrier to anadromous fish species. Grand Coulee Dam (River Mile 596) cut off migration to the upper 1,100 miles of the Columbia and its tributaries. Later, Chief Joseph Dam (River Mile 545) cut off another segment of the Columbia. The Hells Canyon Dam made the upper two-thirds of the Snake River inaccessible to salmon and steelhead when experimental fish passage facilities failed. Dams in the entire basin have eliminated about one-half of the natural habitat once available to anadromous salmon and steelhead. (See Figure 5). The Hanford Reach is the last free-flowing reach of the Columbia River in Washington State and is a very important spawning area (see section IV C. Nos. 3 and 4 of the EIS).

Other problems also affect fish. Reduced flows (as a result of river operation and depletion) increase the juveniles` travel time to the sea, seriously decreasing survival chances. Physiological changes place steelhead and young salmon on a limited time schedule. When migration is delayed, some fish fail to reach the ocean or may be unable to survive the adjustment to salt water and are lost from either fisheries or spawning stocks. Longer travel times also expose juveniles to additional predation. See Appendix F for a discussion of the life cycles and migration characteristics of Columbia River salmon and steelhead.

Passage at dams is another problem. According to the Washington Department of Fisheries, an average of approximately 15 percent of downstream migrants are killed passing through the turbines of each dam. It is believed that this figure varies considerably among particular dams, but is an accurate average figure. It is based on an 11 percent direct turbine mortality and an estimated 4 percent reservoir and predation mortality.

During low flow years, virtually all juvenile downstream migrants from the upper basin are killed passing through turbines and reservoirs of successive main stem hydroelectric projects. In 1973, for example, less than 5 percent of all fish migrating from the Snake River Basin survived to the lower Columbia River below Bonneville Dam.

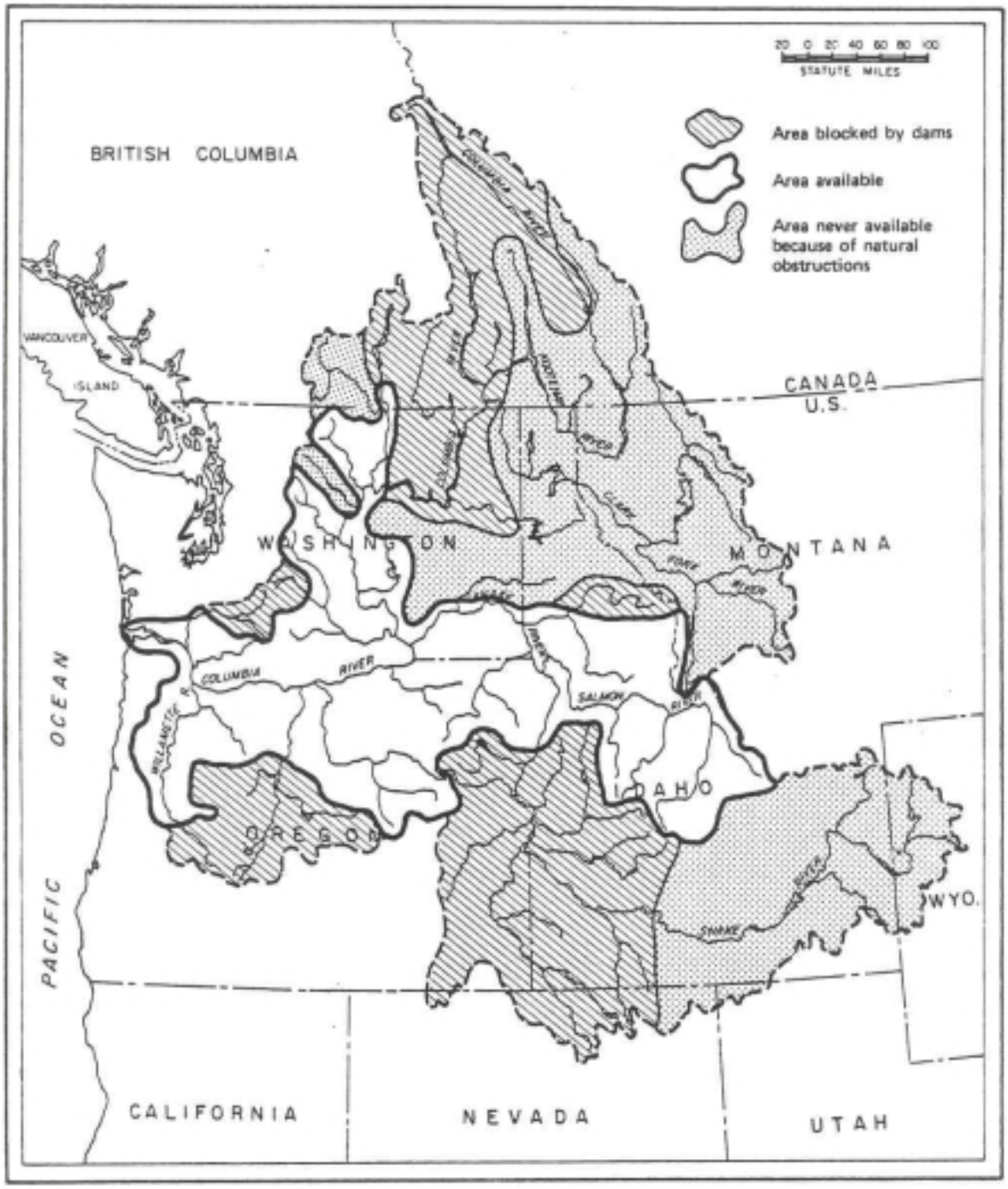


Figure 5. Anadromous Salmon and Steelhead Habitat, Columbia River Basin

Although in recent years juvenile fish migration problems have been far more serious, adult fish returning to spawn may also encounter delay or injury in traveling upstream. They may be physically damaged as they leap against the concrete or are caught in high velocity flows. Fish delayed by dams may not reach the spawning area in time for successful spawning. Delays may also occur as the result of fallback of fish through turbines or over spillways after having successfully negotiated fish passage facilities.

Water required to operate adult fish migration facilities (fish ladders and associated equipment) reduces power generating capabilities slightly. At the four lower Columbia dams, fish ladders require an average of 150-600 cfs which cannot be used to generate power. A larger quantity (up to 2,700 cfs) of auxiliary water is used at each dam to provide additional flow at the mouth of the ladder to attract fish. The power foregone in this operation varies among projects depending on the particular type of operation used.

Nitrogen supersaturation has been found to occur at Columbia and lower Snake River projects. During periods of heavy spill, levels of dissolved gases measured at and between the Columbia and Snake river main stem dams were between 135 and 140 percent. These were well above critical thresholds for both adult and juvenile salmon and steelhead. It is estimated by fishery agencies that the problem resulted in a high mortality of downstream migrants; mortality levels to adult fish are unknown. Nitrogen supersaturation causes gas bubble disease in fish. The disease can directly cause death to the fish or create open sores which are subject to infection. The severity of disease and its consequences depend on the level of supersaturation, duration of exposure, water temperature, general physical condition of the fish, and the swimming depth maintained by the fish. The severity of gas supersaturation has decreased considerably in recent years due to increased Canadian storage and increased hydraulic capacity of the hydroelectric projects which have made spill less frequent. Also, "flip lips" have been installed at a number of projects which help alleviate the problem when spill does occur. These devices have reduced the mortality rate for migrants that pass over the spillway to approximately 2 percent per dam. The recommendations of the Columbia River Fisheries Council for spill at each dam will result in nitrogen levels ranging from 110 percent to 120 percent saturation. These levels are not expected to result in excessive adult or juvenile salmonid mortality.

Mortalities at main stem dams and reservoirs and the loss of major areas of natural habitat have severely reduced the basin's largest, most valuable salmon and steelhead runs. Many of the salmon and steelhead trout populations originating from areas above the Bonneville Dam in the Columbia River are at critical levels. Return per spawner data show a decline in productivity (return per spawner ratio averaged for selected time periods, or brood year) in populations of spring chinook, summer chinook, fall chinook, summer steelhead, and sockeye (Figure 6). Return is estimated as the fish count at Bonneville Dam plus the catch of the river fishery below the dam for summer steelhead and sockeye salmon. For spring chinook, summer chinook, and fall chinook the return count also includes their estimated ocean catch. Spawner is estimated as the fish count at Bonneville Dam, less the Indian fishery catch above the dam. A 1.0 return/ spawner rate means the population is just maintaining itself. If the rate drops below 1.0 and stays below, the population will eventually become extinct. All upper basin salmon and steelhead runs are currently being reviewed for possible inclusion on the national list of threatened or endangered species.

Resident Fish*

At least 14 species of fish contribute to the Columbia River resident sport fisheries. The Department of Game is hopeful that this resource can be developed and utilized to satisfy increasing recreational demands, but is concerned that habitat disruption and competing uses may jeopardize this potential.

The littoral zone is highly productive of aquatic life, but is sensitive to the effects of development and increasing water use. The littoral zone is the aquatic counterpart to the terrestrial riparian corridor. It is that area between the normal high water mark and the lower limit of rooted aquatic vegetation along streams and lakes. In the riverine portions, much of the cross-channel profile is littoral in nature. It is the primary recruitment area; spawning, incubation, and early life history of many Columbia River fish species occurs in the littoral zone.

The littoral zone is very important in providing the nutritional needs of fish and wildlife. Juvenile fish experience their maximum growth rate here. Aquatic insect larvae and larger biota utilized as fish food, such as snails, crayfish, and small fish, are found predominantly in the littoral zone. Some organisms reside on the bottom; others inhabit submerged vegetation, which itself flourishes only where conditions are relatively stable. With the exception of fish and plankton, life forms of the littoral zone are not very mobile. They flourish only in a stable habitat. If the aquatic environment has substantial fluctuation, depletion, or contamination imposed upon it, the littoral zone will be eliminated or radically diminished. One result will be a large reduction of the food supply for fish.

The littoral zone is also important for shelter. Aquatic vegetation provide shelter and concealment. Features such as rocks, bars, ledges, logs, and simply shallow water afford resting, predatory, and escape cover. Rapid and/or large fluctuations in water surface either strand fish, and they usually die, or force them to leave the sanctuary of shallow water.

The littoral zone is 'important to a much larger area than just that which it occupies. Large, rapid fluctuations expose or displace littoral-dependent communities. Very large depletions may have the same effect, but to a lesser degree.

Fisheries-associated recreation is a function of fish abundance and availability. An abundant population which is readily available generates the greatest amount of recreation. A meager but available population may produce some recreation. But abundance without availability yields nothing. Frequent large fluctuations in water levels are detrimental to fisheries-related recreation. As a tailwater or forebay drops, fish move out away from shore, especially if water is shallow. They move back as the water rises. Fish may be present in harvestable numbers in either case, but unavailable to fisheries with a substantial drop in water surface.

An additional limitation concerns physical accessibility. Previously, "availability" was used in the context of the recreationist being able to reach the immediate place where fish are located. Changes in plant operation and river regulation may, also result in physical limitations which prevent the recreationist from getting to where he wants to go.

*Source: Washington Department of Game

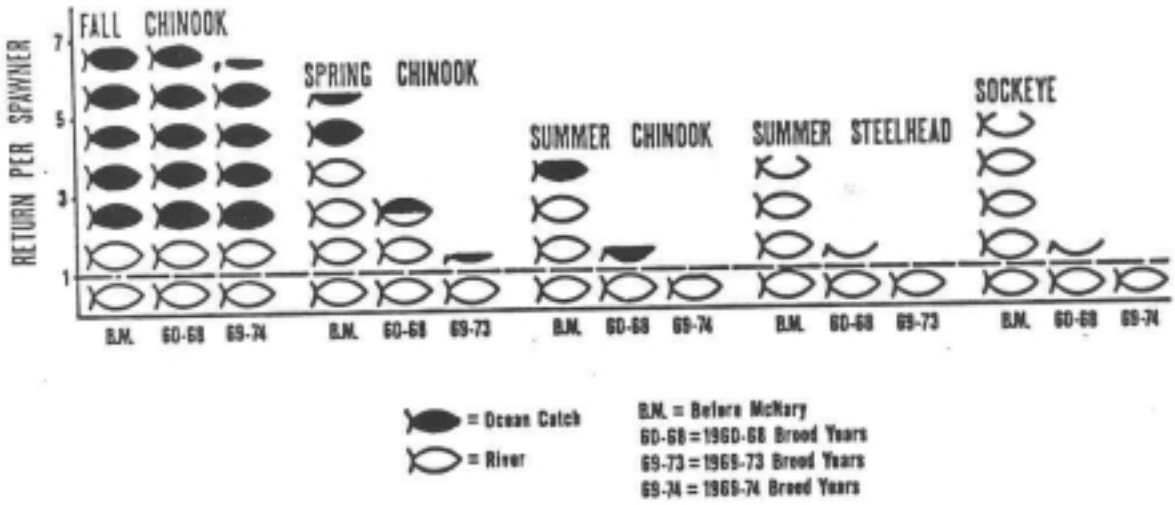


Figure 6. Trend In Production Rates Of Columbia River Runs Originating Above Bonneville

Source: Letter to Washington Department of Ecology from U.S. Fish and Wildlife Service, May 7, 1979.

Wildlife

The Columbia and lower Snake rivers and the areas through which they flow are of considerable value to wildlife. The areas provide habitat for big game, upland birds, waterfowl, furbearing animals, songbirds, shorebirds, raptors, and small mammals. River flow and reservoir level fluctuations threaten wildlife due to existing and potential habitat disruption. The Washington State Department of Game is studying the wildlife impacts of river fluctuations.

Fish and wildlife oriented recreation contribute substantially to the economy of the state. For example, Washington State Department of Game figures for 1977 indicate that each deer harvested contributed $1;200 to Washington's economy, each elk $2,500, and each steelhead $114.. In addition, appreciative users of wildlife have an average expenditure of $10.25 per participant day.

The riparian zone of the river is extremely important, as are the numerous islands. Much of the wildlife along the Columbia and Snake rivers has already been lost to hydroelectric and other water development projects. Remaining populations depend largely on remnant riparian habitats along this river system..

The riparian zone typically features well-established terrestrial vegetative types. It has special ecological significance because many forms of wildlife are dependent on it for food and shelter during critical times of the year. A large portion of the higher elevation habitat near the river may be unsuitable during winter. This tends to emphasize the value of low elevation riparian lands available to wildlife along the Columbia and Snake rivers. Food for the riparian communities includes fruits, seeds, green forage, and insects; many of the wildlife species are themselves part of the food chain.

The riparian corridor is also particularly important because of the shelter it provides wildlife during climatic stress periods. In winter, its three dimensional canopy provides windbreak, heat retention and concealment for wildlife. During summer, a cool, shaded environment is provided for rearing young and protecting adults.

As a general rule, the riparian zone is most developed in the upper reaches of the pools, due to less slope and shallower water. Likewise, most of the spawning and rearing of resident fish also occurs in the upper one-third of the reservoirs. The Washington Department of Game has expressed concern over the amount of development that has occurred in the good habitat areas along the rivers. Much of this development has occurred in flat areas within the upper portion of the reservoirs that are heavily used for wildlife. Grain elevators, cargo handling facilities, and pump stations are examples of current development there. Reservoir and river flow fluctuations threaten wildlife directly and through potential habitat destruction. The Department of Game is studying impacts on wildlife resulting from river regulation for power peaking.

Conflicts between environmental values and river uses generally center around flow fluctuation and reservoir fluctuation. Minimum flow regulations should help minimize many river fluctuation problems.

Recreation

Several major water-related recreation areas are located adjacent to the Columbia River. Nearly 750 river miles provide over 200 water-related outdoor recreation sites in Washington alone. Recreation on the Columbia and Snake is projected to increase substantially during the next 25 years. The "Stewards of the River" program under the Pacific Northwest River Basins Commission provides for coordinated and integrated recreational opportunities along the river. One conflict with future recreational uses of reservoirs is the increased use of hydroelectric plants for peak power generation and the resulting reservoir level fluctuations.

Future uses will need to be carefully planned to insure that a quality recreational experience can be obtained with increased usage.

The only undeveloped segment of the U.S. portion of the Columbia is the 49-mile section between Priest Rapids Dam and the McNary Pool (Lake Wallula), also known as the "Hanford" or "Ben Franklin" reach. More than forty-five miles of this reach are within the Hanford Reservation, where public access was recently restored after being restricted since 1943. The area has significant fish, wildlife, archaeological, scenic, and potential recreational values, all of which have existing or potential economic benefits. However, there is controversy over future use of the Hanford reach. The alternatives include construction of a dam at the Ben Franklin damsite (the last U.S. site on the Columbia River), dredging to permit navigation upstream to Wenatchee, and preservation of the reach as an essentially free flowing stream.

Careful study is needed to determine the impact of opening for recreational use the fragile desert-riparian environment along the shores of the reach. In 1970, the reach was determined to have the potential for inclusion in the National Wild and Scenic Rivers System and was listed under Section 5(d) of the Federal Wild and Scenic Rivers Act (P.L. 90-542). Under this legislation, it is the responsibility of the Corps of Engineers, as the agency considering a construction proposal, to assess the wild, scenic and recreational values of the reach.

Navigation

The Columbia River, together with the Willamette River to Portland, provides the principal waterborne outlet for a large part of Oregon, Washington, and Idaho. Its entrance and interior channels allow navigation service for ships drawing 40 feet to extend 106 miles up the Columbia River to Vancouver, Washington, and 12 miles up the Willamette River to Portland, Oregon. Portland is the principal general cargo port on the river and the major trans-shipment point for commerce moving to and from the interior. Export grain and shipments of forest products are among tire principal outbound items of commerce. A large part of the petroleum products used in the area are brought into the Columbia River by deep-draft tanker and distributed by barge and truck into the interior. Alumina and other ores for the area's industries are important items of commerce. Other major ports on the Columbia River include, Vancouver, which handles large quantities of grain, wood products, chemicals, and ores; Longview, which ships large quantities of grain and forest products; and Kalama and Astoria which are important in the export grain and log trade, respectively. In addition, many industries along the river have specialized facilities for their particular shipping needs.

The most important inland waterway in the region is the Columbia-Snake barge channel. Completed in 1975, it extends from the head of deep-water navigation at Vancouver to the Pasco-Kennewick area on the Columbia River and to Lewiston on the Snake River, 465 miles from the sea and about 740 feet above sea level. An open river channel is maintained from Vancouver to Bonneville Dam. The remainder of the waterway is a slack water channel with locks at eight dams on the Columbia and Snake rivers. This important waterway connects the agricultural hinterland with the deep-draft ports on the lower Columbia River. Downriver movement of grain for traps-shipment to export markets is a major movement on the waterway; upbound commerce includes petroleum products, fertilizer, and other supplies for the interior region.

Waterborne commerce is important to the regional economy. While recent dollar values are not available, tonnage shipped are used as a measure of waterborne commerce significance. Table 10 lists 1975 waterborne commerce tonnages for the Columbia River and inland waterways.

There has been some interest in extending navigation upstream to Wenatchee on the Columbia by installing locks in three existing dam projects, plus dredging or impounding portions of the Hanford reach. This would conflict with preservation of the last remaining nontidal unimpounded reach of the Columbia River in the United States (the Hanford reach) and might cause some impacts on rail and truck transportation as well as Puget Sound shipping.

There are potential conflicts between navigation and other river uses. During low flow periods, the water required to operate the locks reduces power generating capabilities. According to information provided by the U.S. Fish and Wildlife Service, total lockages in 1978 resulted in a power generating loss of almost 142,000 MWH. At a replacement bus bar cost of 20 mills per kilowatt hour, this equates to a value of $2,840,000. This lost potential will increase if the present trend toward increasing use of the river for navigation continues, especially if the proposed Ben Franklin and Asotin projects are built. The operation of the navigation locks on the Columbia/Snake rivers requires approximately 400 cubic feet/second on a daily average basis. This amounts to about 0.2 percent of the average discharge of 194,600 cfs at The Dalles, Oregon. On the other hand, peak load power generation increases navigation problems due to water velocity, flow, and pool level fluctuations. Future port facilities must accommodate these greater water level fluctuations and perhaps compete for preferred locations with future irrigation pump stations and fish and wildlife.

Rural Domestic, Municipal, and Industrial Water Supply

In Washington, municipal water systems serving approximately 92,000 persons obtain their water directly from the main stem of the Columbia. Major municipal systems diverting directly from the river include those for the cities of Wenatchee, Richland, and Pasco. Kennewick is currently constructing facilities to treat Columbia River surface water. Other potential future users of the river for municipal/industrial needs are areas such as the Plymouth Water District, East Wenatchee Water District, and the Vancouver area.

Table 10
Waterborne Commerce
Columbia River and Inland Waterways 1975
(1,000 short tons)*

	Total	Foreign Inbound	Coastwise Receipts	Total Inbound	Foreign Exports	Coastwise Shipments	Total Outbound	Internal Movement
Columbia River								
Portland	19,600	2,030	3,266	5,296	6,560	340	6,900	7,404
Longview	7,300	487	436	923	3,367	36	3,403	3,054
Vancouver	3,467	907	27	934	928	–	928	1,605
Astoria	3,234	42	5	47	1,343	93	1,436	1,751
Kalama	1,549	34	11	45	837	–	837	667
Other Ports	8,546	-	15	15	33	143	176	8,355
Subtotals	43,776	3,500	3,760	7,260	13,068	612	13,680	22,836
Inland Waterways								
Willamette River above Portland	4,999	392	-	392	–	–	–	4,607
Vancouver to The Dalles	7,211	-	-	-	–	–	–	7,211
The Dallas to McNary	3,731		6	6	–	–	–	3,725
McNary to Kennewick	3,144	1	6	6	–	–	–	3,136
Snake River	2,011	-	-	-	–	–	–	2,011
Subtotal	12,210**	392	12	404	–	–	–	20,692
Total	55,986	3,892	3,772	7,664	13,068	612	13,680	43,528

Source: Pacific Northwest River Basins Commission, Water - Today and Tomorrow, Volume II, The Region, June 1979, p. 3-47. (From Waterborne Commerce of the United States, 1975 – Part 4.)

* Short ton = 2,000 pounds .
** Double accounting eliminated

While water withdrawals for most rural domestic, municipal, and industrial uses may involve relatively minor quantities, some industrial uses may utilize significant quantities. For instance, evaporative cooling for a nuclear steam-electric power plant consumes approximately 17,000 AF/yr. per 1,000 MW of generating capacity.

Municipal water supply demands very high water quality even though relatively small quantities are needed. The river currently has acceptable water quality for most municipal and industrial needs. Pollution abatement equipment now being installed should maintain this quality.

Waste Assimilation/Water Quality

The river receives chemical, biological, and thermal and other wastes from a variety of municipal, industrial, and agricultural sources. While extensive waste load reduction programs are in place for both point and nonpoint source wastes, the river serves a valuable function by assimilating and transporting the residual wastes. This function must be carried out without impairing other uses and values (fish, wildlife, domestic water supply, recreation, aesthetic), and water quality standards have been set to assure that these other uses and values are protected.

Observed water quality in the Columbia River generally meets state water quality standards. Temperature standards are exceeded during the late summer due to natural conditions, impoundment, thermal waste discharges, irrigation return flows, and other causes.

Aesthetics

A use of the river often associated with recreation which can also be treated separately is that of aesthetics. To many people, the river is valuable for the sights and sounds that are associated with it. Photographers take advantage of scenic views as do hikers, boaters, and even drivers of automobiles on the highways along the river. While the value of this aspect of the river has not been quantified, the importance of this use of the river to its users should not be underestimated.

IV. SUMMARY OF MANAGEMENT ELEMENTS AND ALTERNATIVE PROGRAMS

The instream resources management elements treated in this program are presented in Table 11, the "Program Formulation Tree." This figure also indicates the relationship of each of these management elements to the principal program objectives. The identification of alternative management elements is intended to be comprehensive including both management elements which are within the Department of Ecology's authority or influence as to implementation and those which are outside such authority or influence. Each of these management elements is briefly described below. Further information on each of these elements is included in the Environmental Impact Statement.

Establishment of Base Flows

This is the establishment of flow levels to protect instream resources. The authority for this type of action is RCW 90.54.020(3)(a).

Establishment of Minimum Flows

This is analogous to the establishment of base flows. The authority for this type of action is Chapter 90.22 RCW which requires the Department of Ecology to establish minimum flows when requested by the Department of Game or the Department of Fisheries. Such a request for the Columbia and Snake rivers was made by the Department of Fisheries by letter dated February 3, 1978. This request included daily average flows, instantaneous flows, and spill. The department's program does not specifically establish spill requirements.

Minimum and/or base flows are established through an administrative process which results in the addition of a new chapter to the Washington Administrative Code.

Conservation and Efficiency Fundamentals

With the department's lack of clear legal authority to establish the conservation and efficiency provision as previously proposed, the establishment of conservation and efficiency fundamentals would delineate the department's policies relating to conservation and efficient use of water resources.

Modification of Project Operation through Negotiation and/or Political Intervention

This would be a continuation and increase in the existing process of frequent discussions among project operators and other river interests with a view toward accommodating the multiple uses of the Columbia River system as a long-term solution to the problem. A recent notable result of this process was the provision of spill at the Columbia River projects to pass juvenile migrants from the Wells project downstream during the 1976-77 drought. This was done pursuant to an emergency FERC order issued in response to a request for action by the governors of Washington, Oregon, and Idaho.

A potential topic for negotiation is the use of the waters stored by Grand Coulee Dam under the Bureau of Reclamation's certificate covering 6,400,000 acre-feet (1938 priority date). The volume of water involved and the priority date (junior only to Rock Island which has no significant storage) gives this matter considerable significance. Active storage at Grand Coulee is 5,200,000 acre-feet.

Federal Energy Regulatory Commission (FERC) Regulation of Non-Federal Hydroelectric Projects.

This occurs through the licensing process authorized under the Federal Power Act of 1920 as amended (16 U.S.C. 791a-825r) and applies to the five PUD projects on the Columbia. Of these, only the license for the Rock Island project expires in the near future, however, the PUDs are voluntarily opening each of the other licenses by applying for modifications. The State of Washington, through the departments of Ecology, Fisheries, or Game, may intervene in the relicensing process. These agencies may also petition FERC at any time for amendment to any licensed project. This is in process for all five PUD projects:

As a result of orders from FERC, two studies are being undertaken which could have a major impact on the future operation of the mid-Columbia projects.

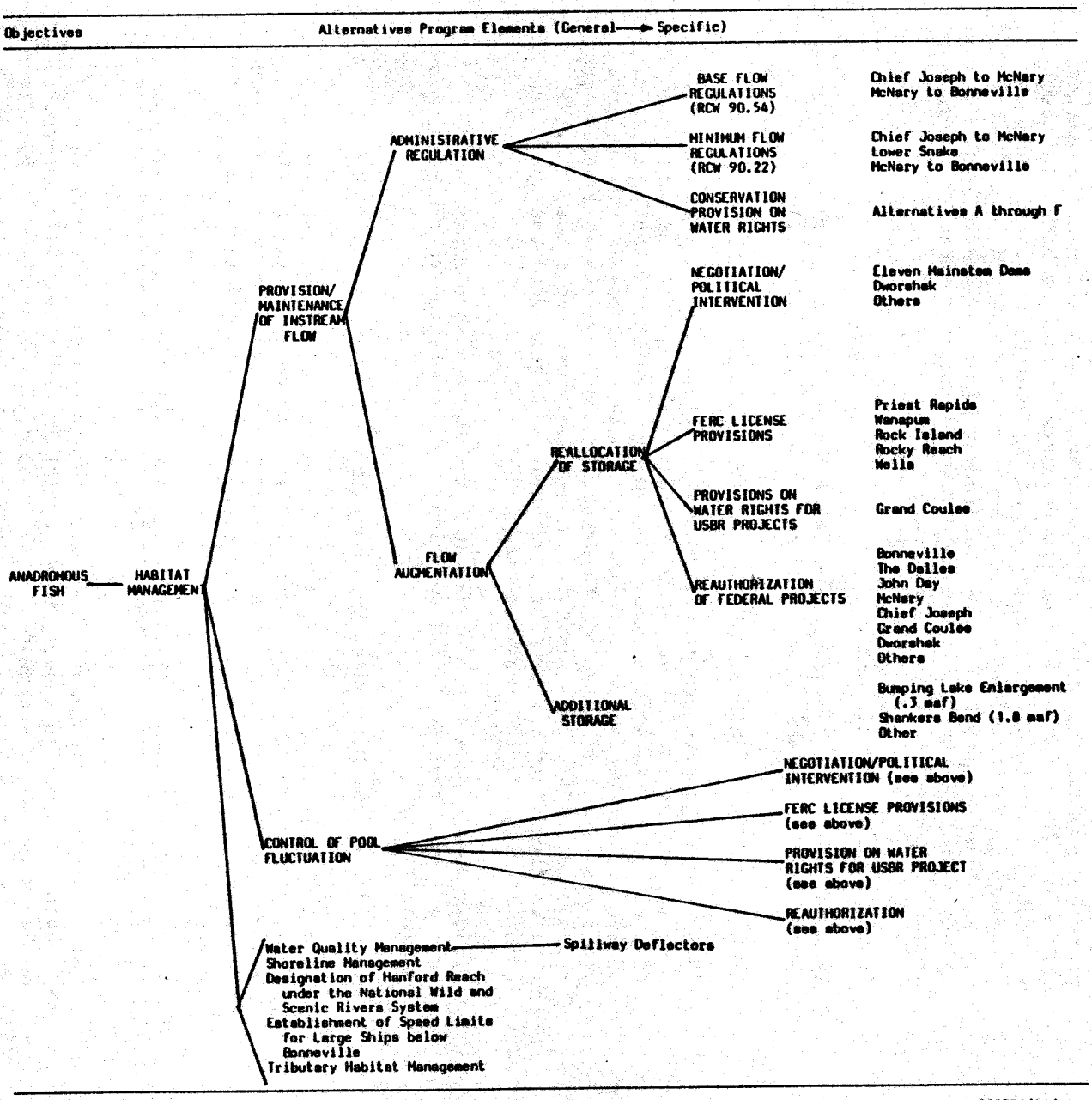
The first of these is commonly known as the Vernita Bar study (Appendix J). It calls for a four-year study of the Vernita Bar spawning grounds utilizing controlled flows from Priest Rapids Dam. Flows of 36,000 and 50,,000 cfs are to be used. There is a provision in the proposed DOE regulation to accommodate such flow control studies.

The second study, commonly known as the "Five-year study," has been only recently agreed upon. It aims at quantifying mortalities associated with downstream migration and testing various means of increasing survival rates of juveniles. DOE was not a party to this agreement and is concerned about its relationship to DOE programs. Appendix K contains both the study agreement and the DOE response.

Overall, it is hoped that both studies will contribute to our understanding of the fisheries problems. If study results indicate that the DOE regulation should be altered, it is DOE's intention to do so.

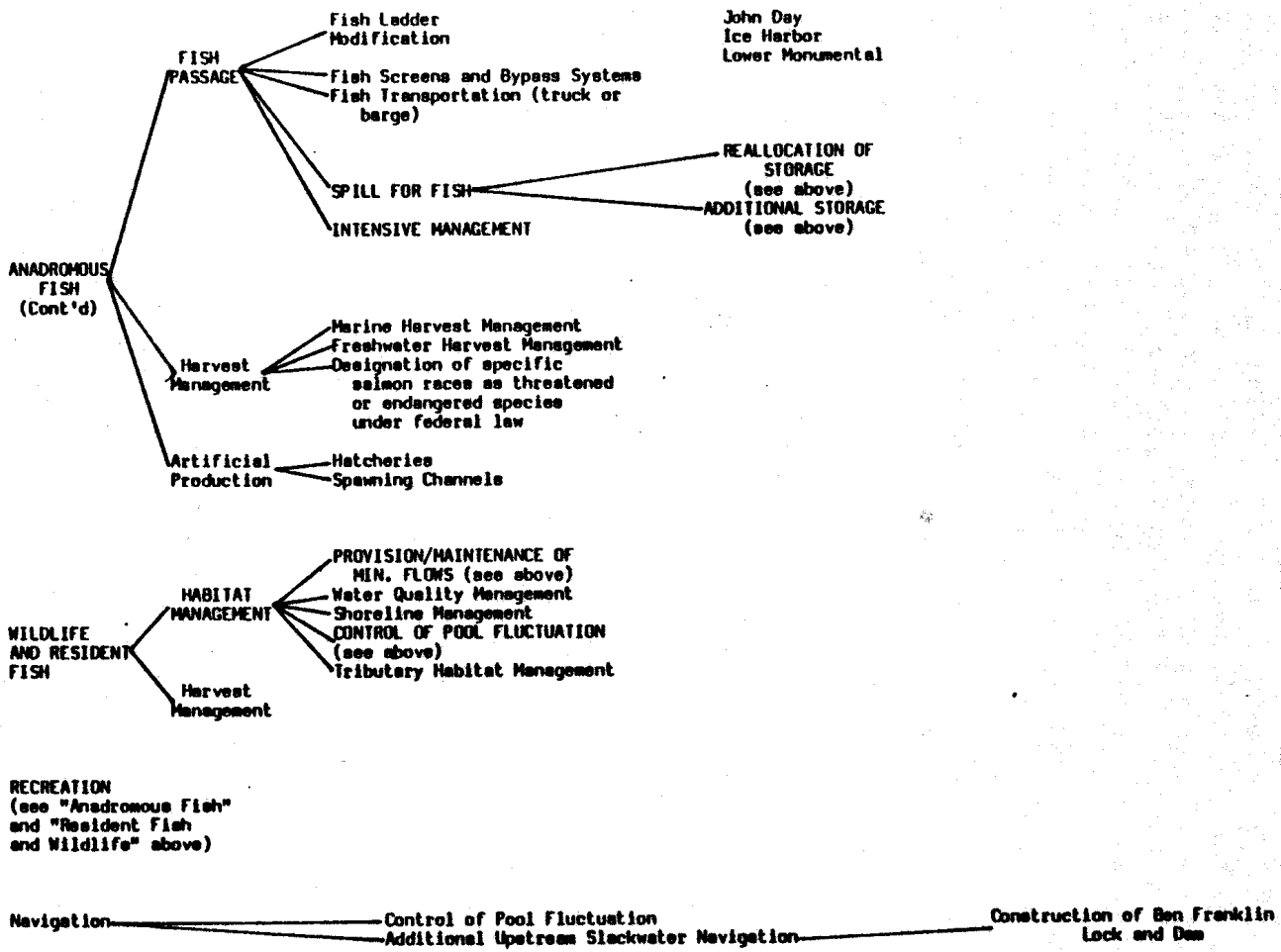
PROGRAM FORMULATION TREE

COLUMBIA RIVER INSTREAM RESOURCE PROTECTION PROGRAM



PROGRAM FORMULATION TREE

COLUMBIA RIVER INSTREAM RESOURCE PROTECTION PROGRAM



Items in CAPS denote principal focus of CRIRPP

020706/AV/N10

Water Right Provisions for U.S. Bureau of Reclamation Projects

Under a July 1978 U.S. Supreme Court ruling (California v. U.S., No. 77-285), the State of Washington would appear to have the authority to specify to some extent the manner of use of waters of the Columbia River above Grand Coulee which have been withdrawn by USBR under the provisions of Chapter 90.40 RCW. These waters include 11,550 cfs for the remainder of the Columbia Basin Project and 206,000 cfs for the Third Powerplant. Such specifications may relate to minimum flows, spill, and/or limits on forebay and tailwater elevation fluctuation.

Authorization and Reauthorization of Federal Projects

This is federal legislative action to modify the authorization of an existing federal project or an addition to a project. This potentially applies to any of the federal projects on the Columbia and could be used to provide fish, wildlife, and other instream uses with legal status as authorized project purposes. This may permit modifications of project operation for the benefit of such uses even though such modifications might adversely affect other authorized uses.

Successful use of this management element realistically requires the cooperation of the federal construction agency. In addition, the cooperation of the States of Oregon and Idaho necessarily would be required in the case of Bonneville, The Dalles, John Day, McNary, and Dworshak.

Additional Storage

This would be the construction of additional reservoir storage capacity in the Columbia River system which would be dedicated in all or part to the protection of instream resources. This would enable the storage of additional water during high flow periods for controlled release for the protection of fish and other instream resources. More specifically, such additional water could be used for the maintenance of assured minimum flows and/or the provision of spill at main stem dams during juvenile migration.

The PNRBC's Regional Program indicates that additional storage of 15,000,000 acre-feet would satisfy all projected water use demands of the system without a reduction in existing power production. However, initial filling of such storage would reduce power production and would affect energy marketing conditions.

Numerous potential storage sites have been identified by various entities in Washington State and elsewhere in the basin. See Table 4 in the Environmental Impact Statement.

Water Quality Management

This would be the continuation of the existing program as provided for under the federal and state water pollution control acts.

Shoreline Management

The Shoreline Management Act (Chapter 90.58 RCW) enacted in 1971 designated the Columbia and Snake River shorelines as "shorelines of statewide significance." As such, the involved cities and counties were required to give special consideration to these shorelines in the development of master programs. The implementing mechanism for these programs is a permit system.

Designation of Hanford reach of the Columbia River under the National Wild and Scenic Rivers System

The Hanford reach has been identified as a potential national wild, scenic, or recreational river under Section 5(d) of the Wild and Scenic Rivers Act (P.L. 90-542). President Carter in 1977 recommended elevating this reach to study status under Section 5(a); Congress has not acted on this recommendation.

If the river were elevated to study status, no federal agency could initiate construction of a project or issue a license (FERC license) for a project on the study segment.

Designation under the national system would preclude the construction of any dam or other structure that would impede the flowing river. It would not impair upstream or downstream activities.

Fish Ladder Modification

Fish ladders are used to pass adult anadromous fish upstream beyond dams. All main stem dams on the Columbia River below Chief Joseph have fish ladders. The lower four dams on the Snake River also have fish ladders.

With the exception of the south shore ladder on John Day Dam, the ladders are quite successful in passing adult salmon and steelhead. The entrance of the south shore ladder on John Day Dam is poorly located, making it difficult for adult fish to find. Further compensation by the Corps of Engineers may involve relocation of the ladder entrance.

Adult American shad (a nonsalmonid, anadromous fish species) were once blocked at Ice Harbor and Lower Monumental dams because of the type of ladder exit. Ladder exit modifications were scheduled for completion at both dams in 1979 to allow shad passage. However, as a result of Idaho Fish and Game Department policy, a removable barrier weir was constructed at the base of the Ice Harbor ladders to prevent shad from entering the ladders. That department wants to study the effects of shad on other fishery resources before approving the passage of shad into the Snake River system. Shad, now very abundant in the lower main stem Columbia River, are indigenous to the Atlantic Coast of North America and were introduced to the Pacific Coast in the 1870's.

Turbine Screens and Bypass Systems

Turbine screens are devices which can be used to reduce the number of downstream migrants that pass through the turbines where high mortality rates are incurred. The screens divert the juveniles into a bypass system leading around the dam.

All units at the Lower Granite and Little Goose projects on the Snake River and two units at McNary on the Columbia have been screened.

Turbine screens have not been perfected and may damage juvenile salmonids. Research is continuing to improve this method of fish passage.

Spillway Deflectors

These are lips which are installed at the end of dam spillways to prevent spilled water from plunging deep in the tailwater pool. This is intended to control dissolved gas supersaturation which is a problem for downstream migrants. Such deflectors have been installed at the Bonneville, McNary, Lower Monumental, Little Goose, and Lower Granite projects. As upstream storage and the hydraulic capacity of the power plants has increased, less water has been spilled. As a result the need for spillway deflectors has diminished.

Fish Transportation

This involves collecting juvenile salmon and steelhead at various dams and transporting these fish downstream by barge, truck, or plane. This technique has been used with some effectiveness on the Snake River during low flow years, but is viewed by the fisheries' agencies as an interim measure until other means of fish passage can be provided.

Fish and Wildlife Harvest Management

This is the ongoing management of sport and commercial harvest of fish and wildlife including the establishment of seasons, gear restrictions, etc. for various species by geographic area. This is wholly outside the scope of the Department of Ecology's authority and influence, but appears to be a significant factor in the decline of the anadromous fish stocks.

Artificial Fish Production

This includes the construction, operation, and maintenance of additional hatcheries, spawning channels, and egg incubation boxes. This is beyond the scope of the Department of Ecology's authority and influence except as it might relate to fish mitigation aspects of a water resources project.

Construction of Ben Franklin Lock and Dam

This would be the construction of a multipurpose dam on the Columbia at river mile 348, north of Richland. One configuration includes a Towhead dam with a 16-unit powerhouse, a 15-bay spillway, and blanks for a navigation lock. The U.S. Army Corps of Engineers is currently studying this proposal.

Intensive Management

Throughout this program, the department has encouraged what it calls "intensive management" of the Columbia River system, including the fisheries resources. Although Columbia River system managers and fishery interests understand what is meant by this term and have been actively engaged in system management for several years, it is important that others also understand the concepts.

In order for the Columbia River system to function effectively and efficiently for flood control, hydropower, and other uses, it has been essential that the activities of the system operators be closely coordinated. In the past, these coordinated activities have resulted in very effective flood damage reduction and hydropower production. In recent years, system coordination and daily-hourly operations have been expanded to increase the emphasis on passage of downstream migrants and other fisheries management problems.

In making the recommendations related to improving conditions for fish and wildlife through the establishment of minimum instream flows and the provision of a volume of water for spill to transport downstream migrants, the department emphasizes the need for increased cooperation between the various users of the system to insure that spill occurs when needed, but also that spill does not occur when fish are not present. While this may require increased personnel or reassignment of existing personnel, such "hands on" or "on-site" management is crucial to maximizing the benefits to fish and wildlife while minimizing impacts on power production.

Spilling water is by no means the only way of achieving successful downstream migration. For example, the project operators and fisheries interests have selectively monitored the attraction and passage of juvenile migrants during the spill program through the use of sonar. The program appears to have been successful, although work is continuing to quantify the number of fish that were passed and to evaluate the techniques.

In the absence of spill, the fish tend to be drawn towards the turbine intakes. Through a sequential dropping of generators, the fish can be moved toward the desired spillway and, when concentrated in the desired area, spill can commence. This has been shown to be one good way of achieving fish passage, although it does not appear to be necessary at all projects. Also, the fish agencies view spill as a short-term solution to downstream migrant problems until physical downstream passage facilities can be made available. Recent sonar studies by the Corps have indicated that the fish tend to be attracted toward the spill even when a larger volume of water is being passed through the turbines. The department encourages the involvement of fish agency personnel in the operation of each project in activities such as these as a major step toward more "intensive management" of the system with an increased emphasis on fish and wildlife protection.

To better define what is meant by "intensive management" related directly to fisheries, the existing manpower is set forth in Table 12 with a suggested level for future activities. This suggested level is the level suggested by the entities listed in the table and not by DOE. These figures include both short-term and annual coordination requirements.

TABLE 12 [1/]
Intensive Management – Columbia River System

Source	1979 FTE (Person-Months)	Suggested (Person-Months)	Difference (Person-Months)
U.S. Bureau of Reclamation [2/]			
Public Utility Districts			
Chelan Co. [3/]	23 ($50,000)		
Douglas Co. [4/]	126 ($522,000)		
Grant Co. [5/]	8 ($35,000)		
U.S. Corps of Engineers [6/]			
U.S. Fish and Wildlife Service [7/]			
National Marine Fisheries Service [8/]			
States			
Washington	3	44	41
Oregon [9/]			
Idaho [10/]			

1/ The figures in this table are rough estimates provided by the agencies listed and are intended to provide a general impression of the amount of interagency cooperation and coordination that is involved in current Columbia River management activities. The information is not intended to serve as a cost estimate of state requirements to replace utility personnel with fisheries personnel to accomplish the program.

2/ The U.S. Bureau of Reclamation is involved in the coordination of flow releases with other uses including fish and wildlife. The amount of coordination varies with runoff conditions and, as a result, the related manpower costs are also variable. For this reason, no firm dollar value was provided.

3/ Chelan County PUD figure does not include any equipment costs, debt service on existing facilities, or cost of replacement energy lost due to spill.

4/ Douglas County PUD figures include the following cost categories: Studies, Artificial Fish Production, Adult Passage, and Fish and Wildlife Supervision and Administration. Some of these costs are continuing annual costs and manpower commitments required by the FERC license, while others are costs associated with specific yearly activities and are variable from year to year. Of the total of 126 person-months, 63 are paid directly by Douglas County PUD and 63 are paid by the Washington departments of Fisheries and Game and reimbursed by the districts. The figures also include Douglas County PUD's wildlife management activities. The dollar figure includes salaries, equipment, supplies, and expenses, but does not include power loss figures (not available) or debt service costs on facilities ($949,600).

5/ Grant County PUD emphasized the difficulty in assigning manpower costs to fishery related activities since Grant County PUD biologists coordinate much of the activities with the fishery agencies. These activities are quite variable depending on factors such as the timing of the fish movements, load conditions, times of day, etc., so that an accurate assignment of costs is very difficult.

6/ U.S. Army Corps of Engineer's comments emphasized the amount of cooperation that is presently involved in Columbia River management activities. No figure for current year or for future activities was available because of the variables introduced by changing runoff conditions and the effectiveness of research and resultant procedures. The Corps' comments emphasized their efforts related to fisheries studies, special actions, and structural improvements for fish. The Corps' activities include: turbine screening, fish hauling; provision of special flows and spills and related studies, monitoring of fish runs, evaluation of techniques such as sequential generator dropping at specific projects, upgrading juvenile fish bypass systems, evaluation and study of adult fish passage facilities, and efforts related to the Lower Snake River Fish and Wildlife Compensation Plan for which the FY 1980 budget request contains the sum of $9.1 million dollars for hatchery and water supply development.

7/ U.S. Fish and Wildlife Service reviewed this section but did not provide written comments.

8/ National Marine Fisheries Service – The Columbia River Fisheries Council expressed concern that the table does not adequately indicate the amount of effort involved in management of the Columbia River fisheries:

9/ Oregon - No response received.

10/ Idaho - No response received.

V. RECOMMENDED PROGRAM

In determining the recommended program discussed in Section V, the department has examined several combinations of the management elements discussed in the preceding section. This examination consisted of a review of the elements and a evaluation of their impacts as discussed in the Environmental Impact Statement. For each alternative, the department has conducted an evaluation of the impacts associated with the combinations of elements involved. The principal alternatives considered are shown in Table 21 of the Environmental Impact Statement. A summary comparison of the seven alternative programs is shown in Table 13.

Based on the recommendations that were made by the power operators, the fish and wildlife agencies, and other concerned groups and individuals, the department developed its recommendations for a program that considers all uses of the system.

The following discussion of the recommended program is divided into three sections. First, a discussion of the program elements that are being recommended by the department; second , a discussion of the impacts associated with the recommended program; and third, a discussion of the proposed implementation strategy. This strategy, as proposed, includes the adoption of administrative regulations as well as statements of department policy. Any administrative regulation adopted by the department in conjunction with this program will include a provision for periodic review to assess the need for program modifications as conditions change in the future. Like the elements of the recommended program, the strategy for implementation may also be revised as the result of input received

In making the recommendations contained in this section, the department encourages intensive management of the river system by all concerned agencies.

The following is a discussion of the elements of the recommended program. No recommendations are made regarding the Snake River. The department plans a review of its current Snake River policies as a future activity.

A. PROGRAM ELEMENTS

Minimum Average Daily Flows

With the addition of a modification to provide a means for reduction of the recommended flows in low water years (the critical flow adjustment), the Department of Ecology (DOE) will establish the minimum average daily flows recommended by the Columbia River Fisheries Council (CRFC) or the existing Corps of Engineers operating flows, whichever are greater. The CRFC flows were recommended in a report dated December 1978 entitled: Recommendations of Columbia River Fisheries Council for Instream Flows in the Columbia and Snake Rivers. These flows are shown in Tables 14 and 15.

TABLE 13
COMPARISON OF ALTERNATIVE PROGRAMS
Columbia River Instream Resource Protection Program

Element	Alternative A	Alternative B	Alternative C	Alternative D*	Alternative E (Existing)	Alternative F	Alternative G	Alternative H (Recommended)
I. Provision, Maintenance of Instream Flows								
1a. Minimum Average Daily Flows	CRFC minimum flow recommendations	COFO 1979 Plan of Action	Same as A.	CRFC & Wash. Environmental Council modifications	Existing FERC license/operating procedure. See Table 8.	CRFC min. flows or existing min. flows, whichever is greater, subject to low runoff adjustment.	CRFC optimum flows.	Same as F.
1b. Minimum Instantaneous Flows.	50,000 cfs.	Further study.	CRFC	70,000 cfs.	Existing FERC license/operating procedure. See Table 8.	At Priest Rapids: 50,000 cfs (except 36,000 Sep 1 - Oct 15) subject to low runoff adjustment. See Table 15	CRFC recommendations with modifications below Bonneville. Wildlife (WDG recommendations -- whichever is greater).	Same as F.
2. Conservation and Efficiency Provision.	Based on forecast at Grand Coulee and The Dalles:	Same as A.	Same as A.	General concurrence - no specific recommendation	- - -	Based on forecast at The Dalles:	Same as A.	Establishment of conservation and efficiency fundamentals.
	Up to 100 % cutback at 60 MAF forecast	Up to 50% pro rata cutback at 52.5 MAF forecast	Same as B.			Up to 50% pro rata cutback at 52.5 MAF forecast	Up to 50% pro rata cutback at 60 MAF forecast	
	Remainder of Columbia Basin Project included.	Remainder of Columbia Basin Project excluded.	Same as A.			Same as B.	Remainder of Columbia Basin Project and application under	Same as B.
	John Day/McNary reservation included.	Same as A.	Same as A.			Same as A.	Same as A.	Same as A.
3. USBR Water Rights.	Negotiation with USBR to reallocate 2.0 MAF for instream resources	1.4 MAF.	2.0 MAF	3.0 MAF.	- - -	2.0 MAF available at Wells Pool and downstream	3.0 MAF Study potential reallocation from other project reservoirs.	Same as F.
4. Federal Project Authorization Reauthorization.	State would support provision of fish passage	Same as A.	Same as A plus fish and wildlife mitigation.	Same as A.	Department would continue to represent the state's interests.	Same as A (for McNary and second powerhouse and additional units at Chief Joseph).	State would support provision of fish passage, habitat restoration, and fish and wildlife compensation. State would pursue reauthorization of all existing Columbia Basin projects to make fish and wildlife authorized project functions.	Same as F.
	State would pursue authorizations for fish and wildlife.	- - -	Same as A.	Same as A.		Department would support inclusion of general language including fish and wildlife as authorized process		Same as F.
	State would cooperate with Idaho regarding Dworshak.	Same as A.	Same as A.	Same as A.		Same as A.		Same as A.
				State would seek Congressional funds for mitigation				

Element	Alternative A	Alternative B	Alternative C	Alternative D*	Alternative E (Existing)	Alternative F	Alternative G	Alternative H (Recommended)
5.	State would seek protection of instream resources through FERC license proceedings	- - -	Same as A.	Same as A plus establishment of flows and fish passage.	Department would continue to represent the state's interests	Same as A, with minimum flows subject to low runoff adjustment.	Same as A to provide optimum flow, spill, and pool fluctuations specified above.	Same as F.
6. Additional Storage	Support Bumping Lake management	Support Bumping Lake	Support ___ Lake with guaranteed water for fish. Removal of Enloe Dam laddering. Support additional storage with fish protection.	Support additional storage with water for fish	Same as A.	*(see original document)*	*(see original document)*	Same as F.
II. Provision of Spill at Columbia River Dams for Passage of Juvenile Fish.	CRFC recommendations	1979 COFO Plan of Action	Same as A.	CRFC plus support for fish passage facilities.	- - -	Volume of 2.0 MAF available for flow and/or spill. Need for intensive system management.	CRFC recommendations	Same as F.
III. Control of Pool Fluctuation.	Seek specified limits based on WDG study.	Same as A.	Same as A.	Same as A plus other data with emphasis on nesting areas.	- - -	Department will consider specific re-commendations based on WDG study plus other data.	Seek specified limits based on WDG study. Control fluctuations to eliminate recreational conflicts and enhance safety.	Same as F.
IV. Other								
1. Ben Franklin Dam	Support USCE study.	Same as A.	Preservation of Hanford Reach	- - -	Same as A.	Same as A.	Oppose USCE study. Preservation of Hanford Reach	- - -
2. Water Quality Management.	Continue existing program.	Same as A.	Same as A.	Improved water quality for fish and wildlife.	Same as A.	Same as A.	Increase effort to bring water quality into compliance with Class A standards below Grand Coulee and Class AA above.	Same as A.
3. Shoreline Management	Continue existing program.	Same as A.	Same as A.	- - -	Same as A.	Same as A.	State will encourage updating of shoreline plans to bring them into line with designation as shorelines of statewide significance with special emphasis on preservation of fish and wildlife habitat	Same as A.
4. Artificial Production	- - -	- - -	- - -	Support for hatchery program including funding.	- - -	- - -	State will support effort to receive past due compensation for present dams.	- - -
5. Natural Production.	- - -	- - -	- - -	Enhance and preserve natural spawning areas.	- - -	- - -	Preserve, restore, and enhance natural spawning areas.	- - -
6. Wildlife	- - -	- - -	- - -	Provision/maintenance of instream flows and conservation cutback provisior	- - -	- - -	Preserve, restore, and enhance wildlife habitat	- - -
7. Recreation	- - -	- - -	- - -	Emphasis on dangers to humans of pool fluctuation	- - -	- - -		- - -

TABLE 14
Minimum Instantaneous Discharge - Columbia River Projects (1,000 cfs)

		GRAND COULEE				CHIEF JOSEPH				WELLS 3/ & ROCKY REACH, ROCK ISLAND & WANAPUM 4/				PRIEST RAPIDS				McNARY & JOHN DAY				THE DALLES			
		Exist	WDG	CRFC	DOE	Exist	WDG	CRFC	DOE	Exist	WDG	CRFC	DOE	Exist	WDG	CRFC	DOE	Exist	WDG	CRFC	DOE	Exist	WDG	CRFC	DOE
JAN		0		1/	2/	0		10	10	0		10	10	36		70	50	12.5			20	12.5		20	20
FEB		0	60		2/	0	60	10	10	0	60	10	10	36	60	70	50	12.5	70		20	12.5	70	20	20
MAR		0	60		2/	0	60	10	10	0	60	10	10	36	60	70	50	50	70		20	50	70	20	50
APR	1-15	0	60		2/	0	60	20	20	0	60	20	20	36	60	70	50	50	70		40	50	70	70	70
	16-25	0	60		2/	0	60	20	20	0	60	30	30	36	60	70	50	50	70	70	70	50	70	70	70
	26-30	0	60		2/	0	60	20	20	0	60	60	50	36	60	70	50	50	70	70	70	50	70	70	70
MAY		0	60		2/	0	60	20	20	0	60	60	50	36	60	60	50	50	70	70	70	50	70	70	70
JUN	1-15	0	60		2/	0	60	20	20	0	60	60	50	36	60	60	50	50	70	70	70	50	70	70	70
	16-30	0	60		2/	0	60	10	10	0	60	20	20	36	60	60	50	50	70		50	50	70	50	50
JUL	1-15	0	60		2/	0	60	10	10	0	60	20	20	36	60	60	50	50	70		50	50	70	50	50
	16-31	0	60		2/	0		10	10	0		60	50	36	60	60	50	50	70		50	50	70	50	50
AUG		0			2/	0		10	10	0		60	50	36		60	50	50			50	50		50	50
SEP		0			2/	0		10	10	0		20	20	36		36	36	50			50	50		40	50
OCT	1-15	0			2/	0		10	10	0		20	20	36		36	36	50			50	50		40	50
	16-31	0			2/	0		10	10	0		20	20	36		70	50	50			50	50		40	50
NOV		0			2/	0		10	10	0		10	10	36		70	50	50			50	50		20	50
DEC		0			2/	0		10	10	0		10	10	36		70	50	12.5			20	12.5		20	20

KEY: Exist. – Existing operating criteria of project.

WDG – Recommended flows – Washington Department of Game.

CRFC – Provisional minimum flow recommendations - Columbia River Fisheries Council.

DOE – Proposed minimum instantaneous discharge - Department of Ecology.

Note: DOE's proposed flows are proposed to be subject to a reduction of up to machine to 25 percent during low flow years, except that in no case shall the outflow from Priest Rapids Dam be less than 36,000 cfs. For Grand Coulee through Wanapum: Minimum instantaneous discharges shall be as shown above, or as necessary to enable minimum flows (subject to low runoff adjustment) at Priest Rapids, whichever is higher.

1/ CRFC has not made recommendations for Grand Coulee.

2/ Minimum instantaneous discharge as necessary to achieve minimum discharge at Priest Rapids.

(3/ Wells: minimum discharge of 16,400 cfs due to machine limitation

(4/ Wanapum: minimum discharge of 8,000 cfs due to machine limitation

*This will change as hydraulic deposits at Wells and Wanapum is increased.

TABLE 15

Minimum Instantaneous Discharge – Columbia River Projects (1,000 cfs)

		GRAND COULEE		CHIEF JOSEPH		WELLS & ROCKY REACH		ROCK ISLAND & WANAPUM		PRIEST RAPIDS			McNARY			JOHN DAY		THE DALLES	
		Exist	CRFC & DOE	Exist	CRFC & DOE	Exist	CRFC & DOE	Exist	CRFC & DOE	Exist	CRFC & DOE	CRFC & DOE	Exist	CRFC 3/ O.F.	CRFC & DOE	Exist	CRFC & DOE	Exist	CRFC & DOE
JAN		1/	2/	1/	30	1/	30	36	30	36		70	12.5	100	60	12.5	60	12.5	60
FEB		1/	2/	1/	30	1/	30	36	30	36		70	12.5	100	60	12.5	60	12.5	60
MAR		1/	2/	1/	30	1/	30	36	30	36		70	50	100	60	50	60	50	60
APR	1-15	1/	2/	1/	50	1/	50	36	60	36		70	50	180	100	50	100	50	120
	16-25	1/	2/	1/	60	1/	60	36	60	36	100	70	50	215	150	50	150	50	160
	26-30	1/	2/	1/	90	1/	100	36	110	36	120	110	50	245	200	50	200	50	200
MAY		1/	2/	1/	100	1/	115	36	130	36	140	130	50	290	220	50	220	50	220
JUN	1-15	1/	2/	1/	80	1/	110	36	110	36	120	110	50	250	200	50	200	50	200
	16-30	1/	2/	1/	60	1/	80	36	80	36	90	80	50	190	120	50	120	50	120
JUL	1-15	1/	2/	1/	60	1/	80	36	80	36		80	50		120	50	120	50	120
	16-31	1/	2/	1/	90	1/	100	36	110	36		110	50		140	50	140	50	140
AUG		1/	2/	1/	85	1/	90	36	95	36		95	50		120	50	120	50	120
SEP		1/	2/	1/	40	1/	40	36	40	36		40	50		60	50	85	50	90
OCT	1-15	1/	2/	1/	30	1/	35	36	40	36		40	50		60	50	85	50	90
	16-31	1/	2/	1/	30	1/	35	36	40	36		70	50		60	50	85	50	90
NOV		1/	2/	1/	30	1/	30	36	30	36		70	50		60	50	60	50	60
DEC		1/	2/	1/	30	1/	30	36	30	36		70	12.5	100	60	12.5	60	12.5	60

KEY: Exist. – Existing operating criteria of project.

CRFC – Provisional minimum flow recommendations - Columbia River Fisheries Council.

DOE – Proposed minimum instantaneous discharge - Department of Ecology.

Note: Grand Coulee through Wanapum - Minimum average daily discharges shall be as proposed above, or as necessary to enable minimum flows (subject to low runoff adjustment) at Priest Rapids, whichever is higher. DOE's proposed flows are proposed to be subject to a reduction of up to 25 percent during low flow years, except that in no case shall the outflow from Priest Rapids Dam be less than 36,000 cfs.

1/ Minimum average daily discharge as necessary to assure 36,000 cfs below Priest Rapids.

2/ Minimum average daily discharge as necessary to achieve minimum discharge (subject to low runoff adjustment) at Priest Rapids.

3/ CRFC Optimum Flow recommendations. Blanks indicate flows yet to be determined.

4/ DOE's recommended flows at Bonneville are the higher of the CRFC or Corps of Engineers operating flows.

The critical flow adjustment of these flows in less than normal runoff years would, when implemented by the Director of the Department of Ecology, result in the provision of at least 75 percent of the CRFC recommended minimum average daily flows. (See Recommended Implementation section, below, for a discussion of the recommended modification of these flows.) A more detailed discussion of the rationale for the recommended flows is included in Section IV.B.6 of the EIS. (See below for a discussion of the department's recommendations related to the provision of spill.) The department's recommendations relate only to the Columbia River and do not include the Snake River system.

The concept of such an adjustment of the recommended flows during low water years is not unique to this program. The National Marine Fisheries Service, the Oregon Department of Fish and Wildlife, and the Yakima Indian Nation, in a petition to the Federal Energy Regulatory Commission (FERC), entitled "Petition for Order for Modification of Project Operation (Emergency Fish Protection)" state:

> "Petitioners strongly urge that, except in low flow years, no change in the proposed schedule be permitted. Petitioners recognize that in a low flow year it is unlikely that Petitioners' recommended flows can be met, and that the impacts of a water shortage should be shared on an equitable basis by all water users, as may be ordered by the Commission."

As a means of comparison, Figure 7 displays several recommended flow regimes for Priest Rapids Dam. Shown are: CRFC and DOE recommended average daily flows; CRFC, WDG, and DOE recommended instantaneous flows; instantaneous flows as required by the existing FERC license; CRFC's 20 percent spill recommendation; and the 25 percent adjustment range to DOE's recommended daily average and instantaneous flows. Also shown are actual monthly average flows observed during 1977, one of the lowest runoff years of record.

The intensive management of the system that occurred during the 1976-77 drought included a major trucking and barging operation for transporting migrant fish. The fishery agencies do not consider this a viable long-term method of achieving successful downstream fish migration. (Trucking and barging of fish is discussed in Section IV.B.1 of the Environmental Impact Statement (EIS)).

Trapping and hauling is considered a stop-gap emergency measure until such time as it has been definitely proven that successful results can be achieved. Recent results of small groups of transported Chinook and steelhead from the Snake River have shown good benefits for the steelhead transports and only fair benefits for the chinook transport. During the 1977 low flow year, mass transportation from the Snake River was initiated in an effort to save the fish. Approximately 1,296,600 chinook smolts and 903,400 steelhead smolts were either trucked or barged from Lower Granite Dam although some losses were incurred in the slack water of Lower Granite Reservoir before the smelts could reach the collection points. The two ocean spring chinook runs from this program returned in 1979. A total of 9,247 were counted at Ice Harbor Dam with an effective spawning population of 6,955 recorded at Lower Granite Dam.

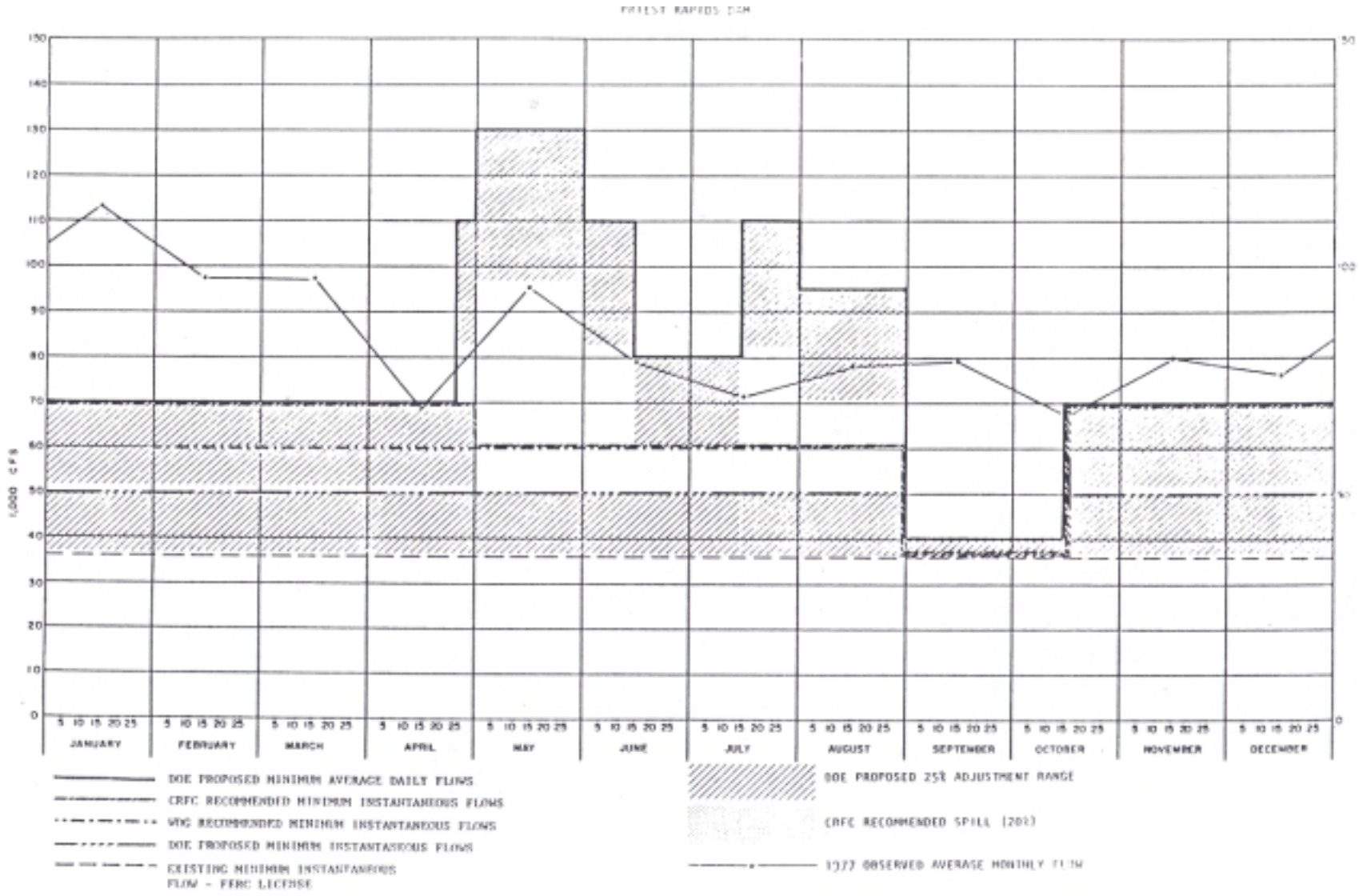


FIGURE 7. Comparison of Recommended Flows – Priest Rapids Dam

Spring chinook smolts from the Middle Columbia River were not transported during 1977. The returns of the two ocean spring chinook runs at Priest Rapids Dam in 1979 were 7,750 fish with an effective spawning population of 6,548 recorded at Rock Island Dam. These initial returns from the first year of mass transport from the Snake River as compared to mid-Columbia nontransported fish do not indicate a successful program.

The CRFC encourages the development of suitable technology and techniques to provide safe passage at minimum cost to other river users.

Minimum Instantaneous Flows

DOE will establish (on an interim basis pending further study) minimum instantaneous flows at all main stem hydroelectric projects in the Columbia River above Priest Rapids sufficient to insure a minimum instantaneous flow of 50,000 cfs at Priest Rapids (except for 36,000 cfs at and above Priest Rapids for the period September 1 through October 15 and except where specific present or future higher FERC license requirements may exist.)

Below Priest Rapids Dam, the department's minimum instantaneous flow recommendation is for those flows recommended by the Columbia River Fisheries Council or the existing U.S. Army Corps of Engineers minimum flows used in project operation, whichever are greater.

Like the minimum average daily flows recommended above, the department proposes a means for modification of the minimum instantaneous flows not to exceed a 25 percent reduction in low flow years. However, in no event will the proposed instantaneous flows fall below 36,000 cfs at Priest Rapids. (See Recommended Implementation discussion below). During the development of the draft documents, DOE staff met with representatives of the mid-Columbia River PUDs to discuss the operational flexibility of their projects as it is affected by instream flow requirements. As a result of this meeting and additional study, the department, as a multi-objective agency, concluded that the flows recommended herein are a reasonable recommendation because the program provides a balance between the various uses through the use of the critical flow adjustment and the conservation and efficiency fundamentals. The impacts of the proposal on power production and other uses is discussed in this section and in the Environmental Impact Statement.

This minimum instantaneous flow is intended to minimize fisheries habitat problems by insuring the operation of the system to provide flow of water through the system. Without question, the uses requiring the greatest quantity of water are hydroelectric power production, fish and wildlife, and irrigation. Consequently, these uses are the greatest cause of conflicts in water use on the Columbia River. This program is aimed primarily at alleviating these conflicts since, when viewed its terms of the total flow of the system, other uses require a relatively small quantity of water.

Conservation and Efficiency Fundamentals

The department will attach a provision to all water right permits issued subsequent to the effective date of Chapter 173-563 WAC requiring the use of up-to-date water conservation practices and maintenance of efficient water delivery systems consistent with established crop requirements and facility capabilities.

Volume of Flow for Fishery Interests

The DOE will continue its negotiations to obtain 2.0 MAF of water for fish and wildlife purposes at River Mile 533.5 (mouth of Okanogan River in Wells pool) and downstream thereof. The purpose of this measure is to provide a legal security in a quantity of water for fish passage purposes. There is no requirement for spill. The fish and wildlife agencies would be free to utilize the water for whatever uses they might prefer, in consultation with the operators, on an annual basis. The department feels that the fisheries interests should assume a more active role in the day-to-day operation of the system. In keeping with such intensive management, the department encourages continued and in some cases increased communication between the power operators and the fish and wildlife interests in order to insure that the system is operated with consideration of all uses. A secured right in a volume of water for spill and other fish passage purposes means that a quantity of water is secured legally with continuity over time for the stated purposes.

It is the department's position that such a quantity of water would be utilized through intensive management of the system for fish passage purposes. Intensive management includes, but is not limited to, such things as timed spill, flow augmentation, and sequential generator dropping, as well as the use of mechanical transport systems, when appropriate.

The quantity of water made available for this purpose would be subject to a maximum recommended reduction of 25 percent during low water years in a manner consistent with that proposed above to insure a degree of sharing of the shortage of a low water year. (See Recommended Implementation discussion of this modification of flows.)

If, in the future, alternative means of safely passing downstream migrants are developed that are acceptable to the fishery agencies, the department would consider adjusting the volume of water required for fish passage purposes.

It is interesting to note that the Columbia River Treaty's Permanent Engineering Board, in its Annual Report to the Governments of the United States and Canada, September 30, 1979 states:

> "Streamflows have been manipulated for nonpower purposes such as accommodating construction in river channels and providing water to assist the downstream migration of juvenile fish in the United States. These arrangements supplement Treaty operating plans and have not created conflicts with operations under those plans. The effects have been beneficial in both countries in accordance with the intent of the Treaty."

Control of Reservoir Pool Fluctuation

The DOE recognizes the problems that occur as a result of pool level fluctuations caused by increased use of the system for peaking power production. These problems include those related to fish and wildlife, public safety, and geological stability. Therefore, the state will consider specific recommendations regarding the establishment of limits on reservoir pool fluctuation at specific projects. The department will utilize available data including the results and recommendations of the Department of Game's current study in developing its recommendations and will consider the benefits derived from peaking operations as well as the possibility of adopting seasonal restrictions, designing facilities to accommodate pool fluctuations, and reducing peak power demands.

Because of the current lack of data, the department is not prepared to make specific recommendations. Rather, it will wait and develop its position as additional information becomes available. For now, the department is simply making a commitment to examine the issue of pool fluctuation limits.

Water Quality Management

The department proposes to continue its existing water quality management program for this system. Although no specific minimum flow is being recommended for use in the NPDES permits, such permits routinely consider flow conditions. The program is discussed in more detail in Section IV.B.4 of the EIS.

Shoreline Management

The department proposes to continue its existing shoreline management program for this system. The program is discussed in more detail in Section IV.C.2 of the EIS.

B. IMPACT ANALYSIS

The information presented in this section is derived from the analysis of the socio/economic/ environmental impacts associated with the department's recommended program, and the alternatives to various program elements, as described in the Environmental Impact Statement. This analysis was considered in the selection of the elements that make up the recommended program. Table 16 contains a descriptive summary of the impacts of program elements. Table 17 provides a summary of program economic impacts. Tables 18 and 19 show impact estimates for some of the alternatives from which the department's recommendation were drawn. The derivation of the impact estimates shown in these latter tables is described in the EIS.

The following qualifications and limitations should be kept in mind as this information is reviewed:

1. Inspection of Table 1.8 indicates that quantitative economic impact estimates have not been provided for a number of program elements. This is due largely to a lack of information upon which to base such analyses. Where possible, qualitative judgments as to the likely direction of impact have been noted via plus or minus signs. Further quantification will be attempted if and as the required information becomes available.

At this time, major quantification efforts have centered upon commercial and sport fisheries, power production, and irrigation – the three river system uses with which the greatest dollar magnitudes are typically associated.

2. All impacts are reported as annual values in constant, 1977 dollars. The choice of 1977 as the base year stems from the fact that this is the latest period for which relatively reliable price index information was available when the analysis was first undertaken. No attempt has been made to "forecast" inflation subsequent to 1977 or into the future. To the extent that inflation affects all program elements in roughly the same degree, the relationships between the impacts reported here will not change over time. To the degree that this condition does not hold, the conclusions drawn from this analysis will have to be reassessed.

3. The dollar amounts reported here stem from analysis of direct impacts only. No attempt has been made to estimate either positive or negative "multiplier" effects for any of these impacts.

TABLE 16
Descriptive Summary of Impacts of the Proposal

Program Element	Fish and Wildlife	Recreation	Natural Environment	Navigation	Electric Energy	Flood Damage Reduction	Irrigation	Municipal and Industrial Water Supply
Establish Minimum Average Daily Flows	Benefits due to increased flows	Benefits due to increased flows. Reduced reservoir-oriented benefits	Benefits due to increased flows	Minimal benefits due to increased flows	Overgeneration losses. reduced reservoir refill capacity	No impact	Losses to future water rights in extreme low flow years	No Impact
Establish Minimum Instantaneous Flows	Benefits due to more constant flows	Benefits due to more constant flows	Benefits due to more constant flows	Minimal benefits due to more constant flows	Overgeneration and peaking capacity losses	No Impact		No Impact
Establish Conservation and Efficiency Fundamentals	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows for power generation	No Impact	Requires more efficient irrigation water use	No Impact
Federal Project Authorization 1/ Changes	Benefits due to language modifications	No Impact	Benefits due to fish and wildlife benefits	No Impact	Impacts on power production depend on any changes in operation due to authorization language	No Impact	No Impact	No Impact
Federal Energy Regulatory Commission Licensing Provisions 1/	Benefits due to increased flows	Benefits due to increased flows	Benefits due to increased flows	No Impact	Reduced power generation flexibility	No Impact	No Impact	No Impact
Seek Volume of Water for Fisheries Interest 1/	Benefits due to water available for fish passage	Benefits due to increased fish and wildlife	Benefits due to increased fish and wildlife	No Impact	Impacts on power generation and operation flexibility	No Impact	No Impact	No Impact
Recommend Additional Storage 1/	Benefits due to flow augmentation impacts due to inundation	Benefits to lake-oriented recreation; loss of stream-oriented recreation	Change rivers into reservoirs, change river flow regime	No Impact	Benefits due to additional stored water available for power production	Possible benefits due to increased storage capacity	Benefits due to availability of more water during irrigation season	No Impact

1/ Actual impacts of these program elements depend on specific changes implemented.

TABLE 17
Summary of Economic Impacts of the Proposal 1/
(millions of 1977 $'s per year)

Program Element	Fish & Wildlife	Electric Energy	Irrigation
Minimum Average Daily Flow Minimum Instantaneous Flow	+34.4 to +59.4	-13.0 to -15.3	- - -
Federal Project Authorizations	Unknown (+)	Unknown (?)	- - -
Federal Energy Regulatory Commission Licensing	Unknown (+)	Unknown (-)	- - -
Volume of Storage for Fisheries Interests	- - - - - - - - - - - - - - - - - SEE NOTE 2/ - - - - - - - - - - - -		
Additional Storage	Unknown (?)	Unknown (+)	Unknown (+)
Control of Pool Fluctuation	No recommendations made at this time.		

Notes: 1/ Values taken from Tables 18 and 20.

2/ No separate estimates were made for this program element. However, if the entire 2 million acre feet were used for spill each year (an unlikely outcome), the values reported for Spill Option C would apply, i.e., +$4.1 to +9.0 million for fisheries; -$12.6 for electrical energy.

TABLE 18
Incremental Impacts of Spill Options at CRFC
Recommended Flow (millions of 1977 $'s per year)

Spill Option (required spill[1])		Fishery Impacts[2]	40-year Average System Generation Loss (MW)	Power Impacts[3]
A.	(0 acre feet)	- - - - - - - - - - - - - - - Baseline Case[4] - - - - - - - - - - - - - - -		
B.	(1.4 million ac. ft.)	$+2.9 to + 6.4	7.3 MW	$- 9.1
C.	(2.0 million ac. ft.)	+4.1 to + 9.0	10.1 MW	-12.6
D.	(3.2 million ac. ft.)	+6.6 to +13.0	16.8 MW	-21.0
E.	(5.0 million ac. ft.)	+10.3 to +23.1	27.1 MW	-33.8
F.	(7.2 million ac. ft.)	+14.5 to +32.9	38.5 MW	-48.1

Notes:

1. The spill is assumed to be continuous. Intensive management could enhance fishery benefits and/or reduce power impacts.

2. Framework used for valuation of enhanced sport fishery relates value per fishing day to average catch per fishing day. The range of fishery impacts reported above is based upon alternative assumptions that increased spurt catch occurs as (1) increases in catch per day over historical fishing days (low value), or (2) increase in fishing days at historical catch per day rates (high value) with estimated value of enhanced commercial fishery added in each case.

3. Average annual system generation loss is valued at assumed thermal replacement rate of 20 mills/kwh (bus bar cost). This impact is substantially revised from that reported in the First Draft E.I.S.

4. Preliminary analysis indicates that C.R.F.C. recommended flows would enhance commercial/sport fisheries without reference to spill requirements. Thus, the amounts reported above may understate fishery enhancement impacts of spill by comparison with current conditions.

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TABLE 19
Fishery Impacts of Flow Options
(millions of 1977 $'s per year)

Flow Option	Fishery Impacts[1]
1. COFO - 1979	Baseline Case
2. C.R.V.C.2	+34.4 to +59.4
3. W.E.C.	+43.1 to 77.4

NOTES:

1. Range of fishery impacts derived by assuming that increases in sport fishery occur as increased catch per day at estimated historical fishing days (low), or increased fishing days at estimated historical catch rates. Commercial fishery impacts added in each case. Values shown are increments over baseline.

2. Fishery impacts of C.R.F.C. flow recommendation also applied to DOE program proposal.

TABLE 20
Power Impacts of Instream Flows[1]
(millions of 1977 $'s per year)

Flow Option	Critical Flow Values			Annual Expected Values[2]		
	Columbia	Snake	System	Columbia	Snake	System
1. COFO - 1979	- Baseline Case- - - - - - - - - - - - - - - - - - - -					
2. DOE Proposal						
Overgeneration						
(a) 100% acceptability	$ 11.2	$ 2.0	$ 13.2	$ 1.7	$ 0.3	$2.0
(b) 75% acceptability	20.0	3.5	23.5	3.0	0.5	3.5
(c) 25% acceptability	36.8	6.5	43.3	5.5	1.0	6.5
Peaking Capacity	9.6	2.4	12.0	9.6	2.4	12.0
Total						
(a) 100% acceptability	$ 20.8	$ 4.4	$ 25.2	$ 11.3	$ 2.7	$ 14.0
(b) 75% acceptability	29.6	5.9	35.5	12.6	2.9	15.5
(c) 25% acceptability	46.4	8.9	55.3	15.1	3.4	18.5
3. C.R.F.C.						
Overgeneration						
(a) 100% acceptability	$ 33.4	$ 8.4	$ 41.8	$ 5.0	$ 1.3	$ 6.3
(b) 75% acceptability	59.1	14.9	73.9	8.9	2.2	11.1
(c) 25% acceptability	110.5	27.6	138.1	16.6	4.1	20.7
Peaking Capacity	20.8	5.2	26.0	20.8	5.2	26.0
Total						
(a) 100% acceptability	$ 54.2	$ 13.6	$ 67.8	$ 25.8	$ 6.5	$ 32.3
(b) 75% acceptability	79.9	20.1	99.9	29.7	7.4	37.1
(c) 25% acceptability	110.5	32.8	164.1	37.4	9.3	46.7

NOTES

1. The assumptions and unit values upon which this table are based include:

   – transmission loss of 16 percent (8 percent each way) on overgeneration

   – replacement of transmission acrd acceptability loss at $0.02/kwh and storage charges of $0.002/kwh; gas turbine peaking capacity at 30.00/MW/yr.

2. Expected values calculated via critical flow values and probability weight of 0.15 (provided by BPA)

C. RECOMMENDED IMPLEMENTATION

The following is a discussion of the department's proposals to implement the recommendations discussed above. The proposed implementation of the department's recommendations is influenced by a number of factors. The Department of Ecology is a multi-objective agency. As such it is charged with the responsibility of considering a variety of viewpoints in developing its programs. In developing the recommendations included herein, the department has requested and received information related to Columbia River management from a number of sources. In keeping with the multi-objective nature of the Department of Ecology, every effort has been made to develop a program for protection of Columbia River Instream Resources that is fair and that does not place an unfair burden on any single user group. With the recommendation included in this section, the department is presenting a program which, in its judgment, provides a fair and reasonable balance among the competing uses.

The State of Washington is by no means the only entity involved in Columbia River management. The river and its uses affect several states, Canada, and the entire Pacific Northwest Region. Because of the regional nature of the river and the jurisdictional conflicts that exist, the implementation activities will require considerable interaction between the Department of Ecology and other interests and user groups.

Although implementation of portions of the program may be difficult, the department views this program as an excellent opportunity to clearly present the State of Washington's position regarding Columbia River management.

Instream Flows

1. Minimum Average Daily Flows

The department will adopt an administrative regulation establishing minimum average daily flows for the main stem Columbia River. These flows are those of the Columbia River Fisheries Council or the existing Corps of Engineers minimum operating flows, whichever are greater. See Table 15. Flow modifications during low flow years will be accomplished as follows:

The Director of the Department of Ecology may reduce the minimum average daily flows when the March 1 forecast of unregulated April through September flow at The Dalles is less than 88 million acre-feet and when, in the Director's opinion, such a reduction is in the public interest. If the forecasted flow is less than 88 million acre-feet, and if the Director chooses to implement this critical flow adjustment, the amount of the reduction will be determined by the critical flow adjustment shown in Figure 8. If the forecasted flow is equal to or less than 52.5 million acre-feet, the maximum adjustment that may be required is 25 percent. If the forecasted flow is greater than or equal to 88 million acre-feet, no critical flow adjustment shall be required. Table 21 shows minimum average daily flows at Priest Rapids for several levels of critical flow adjustment based on Figure 8. Figure 9 shows the forecast and "observed" flows for 1977, 1978, and 1979 as well as the actual gaged flows for the same period.

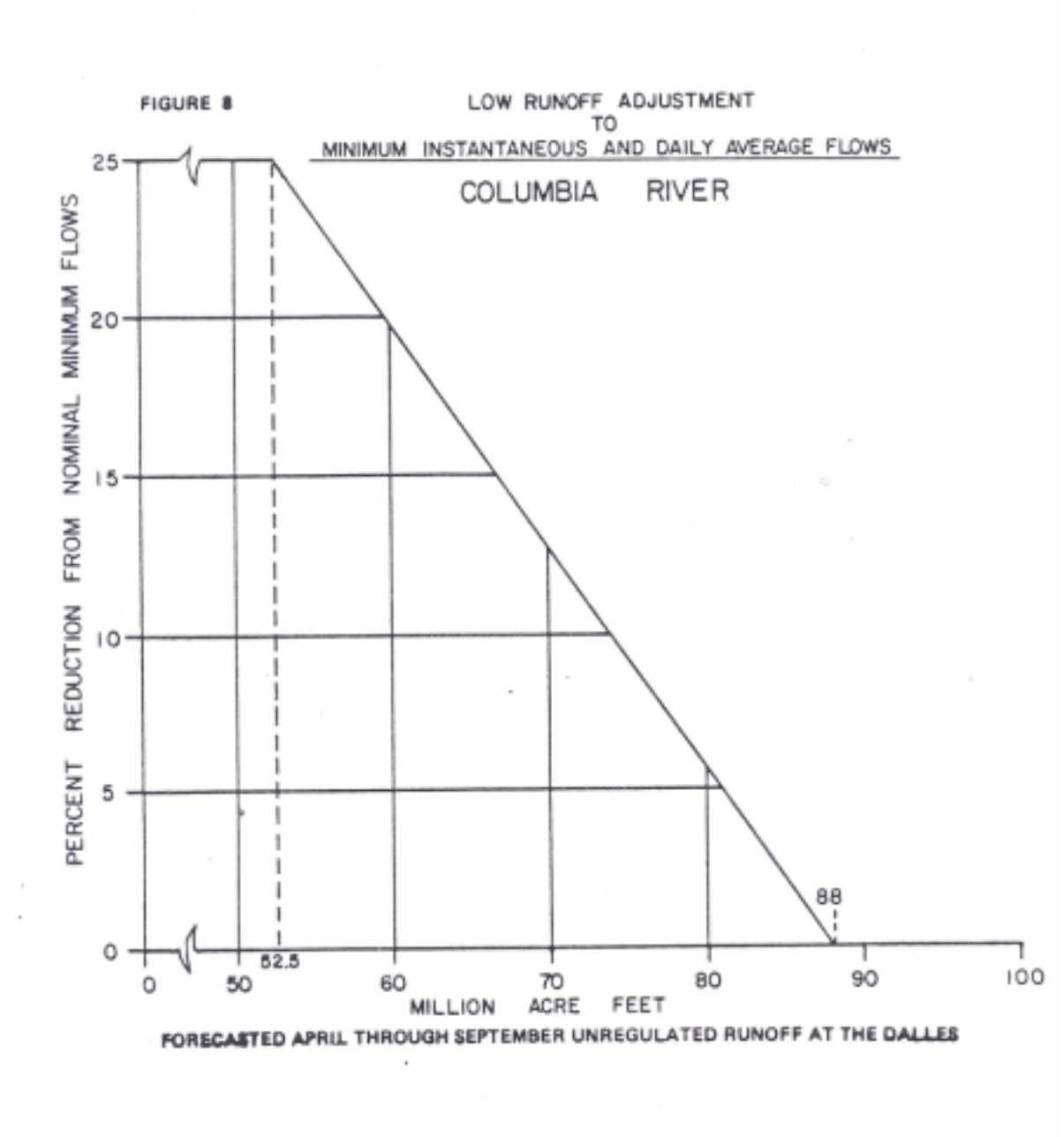
FIGURE 8
LOW RUNOFF ADJUSTMENT
TO
MINIMUM INSTANTANEOUS AND DAILY AVERAGE FLOWS
COLUMBIA RIVER
PERCENT REDUCTION FROM NOMINAL MINIMUM FLOWS
25
20
15
10
5
0
52.5
88
0
50
60
70
80
90
100
MILLION ACRE FEET
FORECASTED APRIL THROUGH SEPTEMBER UNREGULATED RUNOFF AT THE DALLES

Figure 8

TABLE 21
Priest Rapids[1/] Minimum Daily Average Flows
By Percent Reduction

Month	0%[2/]	5%	10%	15%	20%	25% 3/
JAN	70	67	63	59	56	53
FEB	70	67	63	59	56	53
MAR	70	67	63	59	56	53
APR 1 to 15	70	67	63	59	56	53
16 to 25	70	67	63	59	56	53
26 to 30	110	105	99	93	88	83
MAY	130	123	117	111	104	97
JUN 1 to 15	110	105	99	93	88	83
16 to 30	80	76	72	68	64	60
JUL 1 to 15	80	76	72	68	64	60
16 to 30	110	105	99	93	88	83
AUG	95	90	85	81	76	71
SEP	40	38	36	36 4/	36 4/	36 4/
OCT 1 to 15	40	38	36	36 4/	36 4/	36 4/
16 to 31	70	67	63	59	56	53
NOV	70	67	63	59	56	53
DEC	70	67	63	59	56	53

1/ Under present operating criteria, Priest Rapids and upstream projects are operated to meet a minimum instantaneous flow of 36,000 cu. ft. per second in the Hanford Reach.

2/ Columbia River Fishery Council recommended minimum daily average flows. These would apply in years when the March 1 water supply forecast for April-September at The Dalles is 88 million acre-feet or more.

3/ 75 percent of Columbia River Fishery Council recommended minimum daily average flows. These would apply in years when the March 1 water supply forecast for April-September at The Dalles is 52.5 million acre-feet or less.

4/ 25 percent reduction would fall below 36,000 cfs FERC license requirement at Priest Rapids Dam. The department's recommended minimum flows will in no case fall below 36,000 cfs at Priest Rapids.

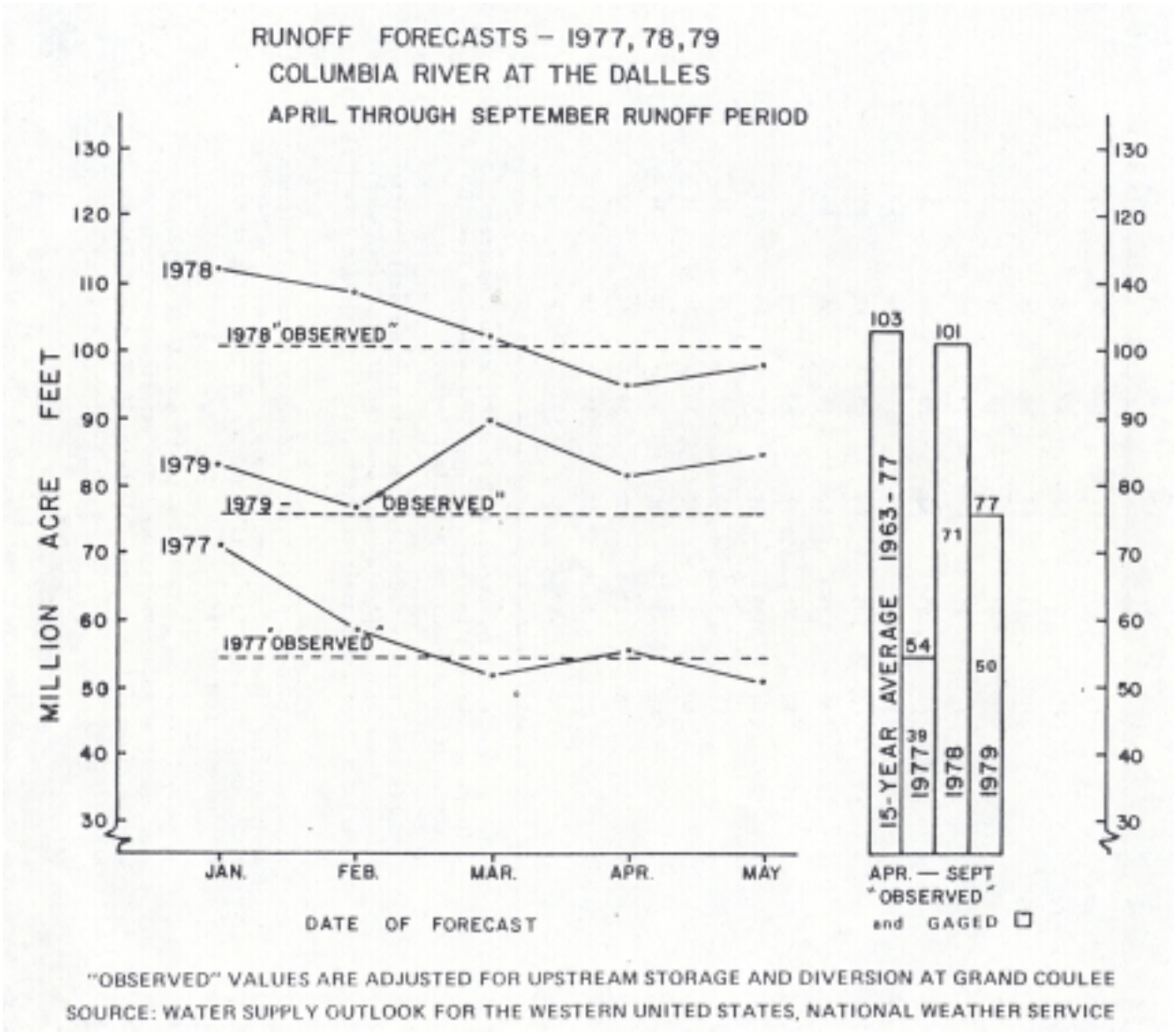
RUNOFF FORECASTS – 1977, 78, 79
COLUMBIA RIVER AT THE DALLES
APRIL THROUGH SEPTEMBER RUNOFF PERIOD
MILLION ACRE FEET
130
120
110
100
90
80
70
60
50
40
30
1978
1978 "OBSERVED"
1979
1979 – "OBSERVED"
1977
1977 OBSERVED
JAN.
FEB.
MAR.
APR.
MAY
DATE OF FORECAST
15-YEAR AVERAGE 1963-77
103
54
1977
39
101
71
1978
77
50
1979
APR. — SEPT
"OBSERVED"
and GAGED
"OBSERVED" VALUES ARE ADJUSTED FOR UPSTREAM STORAGE AND DIVERSION AT GRAND COULEE
SOURCE: WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, NATIONAL WEATHER SERVICE

Figure 9

2. Minimum Instantaneous Flow

The department will establish, by administrative regulation interim minimum instantaneous flows as shown in Table 14. These flow requirements would he on an interim basis pending further study of the needs under conditions of intensive system management. These recommended flows were the result of consideration of the fish and wildlife interests' recommendations and those of the power interests and, in the department's judgment, represent a reasonable water management position. The department's proposed interim minimum instantaneous flows are also subject to a maximum 25 percent reduction during low flow years. The percentage of reduction is to be the same as that for the proposed minimum average daily flows above, except that in no case will the proposed minimum instantaneous flows fall below 36,000 cfs at Priest Rapids Dam. See Figure 8.

Like the proposed reduction to the minimum average daily flows, the reduction of the minimum instantaneous flows may be required by the director when, in his opinion, overriding considerations of the public interest will lie served by such an action.

Future surface and ground water right permits and certificates which have a significant and direct impact on the surface waters of the main stem Columbia River will be subject to these minimum instream flows.

Conservation and Efficiency Fundamentals

The department intends to attach a provision to future instream and out-of-stream water rights to foster conservation of the state's water resources and a sharing of the burden of water shortages in low water years to the greatest extent practicable. This will be done pursuant to proposed Chapter 173-563 WAC and will require the use of up-to-date water conservation practices and maintenance of efficient water delivery systems.

Volume of Flow for Fishery Interests

The department intends, as a matter of policy, to continue to negotiate with various interests on the Columbia River system to identify up to 2.0 MAF of water for fish and wildlife purposes available at, and downstream of, River Mile 533.5 (mouth of Okanogan River in Wells Pool). It is the department's intention that such water would be made available on a system-wide basis to assure maximum flexibility. The 2.0 MAF, as recommended, includes 1.4 MAF from storage above Chief Joseph Dam and approximately 600,000 acre-feet to be provided by additional storage on the Similkameen River, a tributary of the Okanogan River. The department recognizes that there may be environmental problems associated with the development of such storage.

The purpose of this measure is to provide a legal security in a quantity of water that can be used for fish passage purposes through intensive system management involving the power, irrigation, and flood control operators and the fish and wildlife interests.

Department personnel have met with representatives of the U.S. Bureau of Reclamation (WPRS) to discuss this proposal. The WPRS has subsequently requested a solicitor's opinion regarding the legal implications of such an action.

Such a water right would include a provision for reduction of the quantity of water made available during low water years. Such a provision would detail the way in which a reduction in quantity would be implemented and would help foster a sharing of the burden during low water years.

The department will encourage and support reasonable efforts that would result in more intensive management of the Columbia River system. The department does not specifically support the spill recommendations of the CRFC. If the department secures a quantity of water dedicated to the provision of a volume of storage for fishery interests, (see discussion above), that water could then be utilized for the provision of spill and/or flow as desired by the fish and wildlife managers, in consultation with the system operators and through intensive system management.

Federal Project Authorization and Reauthorization

The department intends, as a matter of policy, to seek appropriate language for the purpose of establishing an authorization inclusive of fish and wildlife purposes for the following projects:

1. McNary 2nd powerhouse
2. Chief Joseph additional units (beyond 27)
3. Others as appropriate

The department will seek the concurrence of Oregon and Idaho in its efforts related to the McNary Project.

The department has requested the State Attorney General's Office to conduct a legal review of the authorization process and the existing authorization language for the purpose of providing the department wilt specific language related to the protection of fish, wildlife, and other instream resources

The department intends, as a matter of policy, to cooperate and support efforts of the State of Idaho directed toward authorization of the Dworshak Dam project to include fish, wildlife, and older instream uses as authorized purposes.

The department supports inclusion of language in project authorizations and re-authorizations that would establish an authorization inclusive of fish and wildlife. The department reserves the right to continuing review of its support where specific project operation criteria are being proposed.

PERC Licensing

The department may utilize the program herein in its representation of state interest in the FERC license amendment proceedings for Priest Rapids-Wanapum, Rock Island, Rocky Reach, and Wells Dam for the purposes of providing long-term protection for fish, wildlife, and other instream uses. This utilization would be conditioned on the establishment of provisions for the reduction of the quantity of water provided for fish, wildlife, and other instream resources during low water years in a manner consistent with that proposed in this section and be limited to the interim instantaneous flows recommended herein. This program provides no treatment of spill outside of that provided in the discussion entitled "Volume of Flow for Fishery Interests."

The department is now an intervenor in the FERC proceedings on the mid-Columbia fisheries flow issues. The primary aim of this action by DOE is to promote the idea of modification of the recommended minimum instantaneous anti daily average flows during low water years to assure a "sharing of the burden" and a more balanced use of the resource.

Additional Storage

The department supports environmentally and economically sound additional storage on the Columbia River system. A list of potential storage projects and related information is provided in section IV.A.1 of the EIS.

In supporting further study of additional storage, the Similkameen River appears to offer the greatest potential for supplying up to 600,000 acre-feet of assured flow augmentation from a "new" source in this state. The proposed high dam project on the Similkameen River would create approximately 1,800,000 acre-feet of storage. Therefore, the department may provide its philosophical support; provide funding for all or a portion of a study; or conduct certain preliminary feasibility studies can its own.

Governor Ray and the Yakima Indian Nation recently announced the "Yakima River Basin Water Enhancement Project" which is designed to resolve conflicts arising over water use in the Yakima River System. The program consists of six principal storage projects with a total active storage capacity of 1,022,100 acre-feet.

Provision of Spill at Columbia River Dams for Passage of Juvenile Fish

(See discussion of Volume of Flow for Fishery Interests.)

The department does not intend to make specific requirements regarding the provision of a percentage of flow for spill. Rather, its intent is to assure the availability of a quantity of water for the protection of fish, wildlife, and other instream resources that can be used to provide any combination of spill and flow for the safe transportation of juvenile migrants through intensive management of the system by facility operators and fisheries management agencies.

FINAL
ENVIRONMENTAL IMPACT STATEMENT

Prepared in accordance with the
Washington State Environmental Policy Act

Relative to Proposed Administrative Action by
the Department of Ecology

COLUMBIA RIVER
INSTREAM RESOURCE PROTECTION PROGRAM

June 1980

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WILBUR G. HALLAUER, DIRECTOR

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INTRODUCTION

The Washington State Department of Ecology proposes to adopt the program discussed in the preceding "program document." The program, known as the Columbia River Instream Resources Protection Program (CRIRPP), is designed to establish the state of Washington's position regarding the Columbia River and its competing uses.

DOE first published its proposal in March of 1979 along with a draft EIS. Since this is such a broad subject and affects so many personal and agency interests, the first draft documents generated a great deal of discussion. The department received dozens of comments, many of a very lengthy and detailed nature. In response to the comments and suggestion for changes, DOE decided to reissue the program document and EIS for another round of comments. Suggested changes and other new material have been added. Although the letters received in response to the first draft are not included, they are available on request.

To avoid duplication, the revised draft program document and EIS have been combined in this one volume. In addition, separately published background documents are included by reference. The program document and the referenced information are all to be considered part of the EIS.

Lead Agency: Washington State Department of Ecology

Responsible Official:	John Spencer, Assistant Director Office of Water Programs Department of Ecology
Contact Person:	Jim Bucknell, Project Manager Washington State Department of Ecology, MS PV-11 Olympia, Washington 98504 Phone: (206) 753-6877

Author: Department of Ecology staff, with input from other state and federal agencies.
Tom Elwell, Coordinator

Licenses Required: The department will adopt the program and appropriate administrative regulations.

Background Data: See Appendix A.

Cost to the Public: Individual copies of this document may be obtained at no charge from DOE while supplies last.

Date of Issue: Draft EIS: Revised March 30, 1979
Draft EIS: February 5, 1980
Final EIS: June 16, 1980

Distribution: See Appendix B

BACKGROUND

The Department of Ecology has been charged with the responsibility of managing the water resources of the State of Washington (Chapter 90.54 RCW). The purpose of the Columbia River Instream Resource Protection Program is to establish the state's policies to "insure the future viability of instream resource values of the main stem of the Columbia River and the main stem of the Snake River, including fish, wildlife, recreation, aesthetics, navigation, and hydropower resource values" (WAC 173-531-060). The Snake River will be addressed by the department as a separate activity. The Department of Ecology is undertaking this project with full knowledge of the limitations of the State of Washington. It realizes that management of the Columbia River involves other states and many federal agencies. The department is a multi-objective agency and is required to consider all uses of the Columbia River in developing its programs. As a result, DOE views itself as an agency that has the responsibility to examine the available information and to make specific recommendations that attempt to resolve the conflicts between the various interests.

Numerous recent publications have pointed out that while the Columbia River appears to have an excess of water, this is not really the case. During years of low and average runoff, there is not sufficient water in the Columbia Basin to serve all demands simultaneously. Therefore, management of the Columbia River to the greatest benefit of its users is a matter of delicate balance between fish and wildlife, power, irrigation, navigation, municipal and industrial water supply, recreation, and flood control.

In this effort, the Department of Ecology is following the direction provided in the Water Resources Act of 1971, Chapter 90.54 RCW, that "proper utilization of the water resources of this state is necessary to the promotion of public health and the economic well-being of the state and the preservation of its natural resources and aesthetic values" and that the state shall "insure that waters of the state are protected and fully utilized for the greatest benefit to the people of the State of Washington . . ." (RCW 94.54.010). A balanced diversification of uses of the Columbia River will provide the greatest economic and social benefits to the people of Washington and the Pacific Northwest.

The specific requirement to develop a program to protect instream resources in the Columbia River at this time is contained in WAC 173-531-060 pursuant to Chapter 90.54 RCW. To meet this requirement, the Department of Ecology has developed goals and objectives, some alternative programs, and a proposed program after working with Columbia River user groups, environmental groups, and interested individuals (see Appendix D for more information on public involvement). The goals and objectives and the recommended program are the result of the department's effort to develop a program for instream resource protection that provides some balance of the conflicting uses and priorities of use on the Columbia River.

SUMMARY

Essentially, the proposed action provides a focus for regional planning for the Columbia River system from the State of Washington's perspective. To implement this proposal, the department had developed a program consisting of actions which it can implement as well as actions which others must take. By seeking comment and discussion via this document, the department hopes to achieve a coordinated effort.

To be consistent and compatible with regional efforts, the goals and objectives for this program are based on (but are not identical to) those set forth by the Pacific Northwest River Basins Commission in Water – Today and Tomorrow: A Pacific Northwest Regional Program for Water and Related Resources, Volume II, June 1979. Washington State, as a member of the Pacific Northwest River Basins Commission, participated in the drafting of these goals and objectives.

To meet the objectives, a series of management options were investigated and evaluated. Table 1 displays the primary goals and objectives, including a list of the management options that are related to each objective. The table also includes the location in the text of a description and discussion of each option. See Table 1 of the Program Document for a more complete display of the goals and objectives.

Proposal

The proposal is to provide instream resource protection for the Columbia River. This protection can be divided into three parts: 1) provision of minimum flows, 2) allocation of volume, and 3) control of reservoir level fluctuation. The major elements of the program are:

1. Existing water rights are not affected by this program.

2. Establish minimum average daily flows by administrative regulation. The proposed flows include a provision for reduction during low water years.

3. Establish minimum instantaneous flows by administrative regulation. The proposed flows include a provision for reduction during low water years.

4. Establish conservation and efficiency fundamentals by administrative regulation to guide the department in its efforts to insure that the state's water resources are conserved.

5. Provide a volume of water for fish and wildlife benefits by negotiation. The use of this water is to be determined by the system operators and the fish and wildlife interests. (The department's proposal does not include specific recommendations related to spill.)

TABLE 1

Goal: To maintain or enhance the quality of life in the Pacific Northwest

Basic elements of "quality of life" are

- Economic well-being
- Environmental quality
- Social well-being,

Objectives	Management Options	Location in Text
Fish and Wildlife	Additional storage in tributary areas	IV.A.1
	Fish ladders	IV.A.2
	Fish screens and bypass systems	IV.A.3
	Spillway deflectors	IV.A.4
	Hatcheries and spawning channels	IV.A.5
	Transportation of fish around dams	IV.B.1
	Provisions for spill at dams	IV.B.2
	Reallocation of storage	IV.B.3
	Water quality management	IV.B.4
	Conservation provision on water rights	IV.B.5
	Establishment of base flows	IV.B.6
	Harvest management	IV.B.7
	Habitat management	IV.B.8
	Control of pool fluctuation	IV.C.1
	Shorelands management	IV.C.2
	Designation of Hanford Reach as wild and scenic river	IV.C.4
Recreation	Control of pool fluctuation	IV.C.1
	Shorelands management	IV.C.2
	Water quality management	IV.B.4
Natural and Cultural Environment	Designation of Hanford Reach as wild and scenic river	IV.C.4
	Water quality management	IV.B.4
	Shorelands management	IV.C.2
Navigation	Ben Franklin Lock and Dam	IV.C.3
	Control of pool fluctuation	IV.C.1
	Establishment of base flows	IV.B.6

6. For federal projects: seek authorization language to include fish and wildlife purposes.

7. For nonfederal projects: intervene in FERC licensing proceedings to seek flow provisions.

8. Encourage intensive management of the system for all uses, specifically including fish and wildlife.

9. Make commitment to consider specific recommendations regarding reservoir fluctuation limits when information becomes available.

The waters associated with the second half of the Columbia Basin Project are excluded from the provisions of this program.

The impacts of the proposal are generally beneficial to fish, wildlife, and recreation while potentially adverse to hydroelectric power and irrigation. The main adverse impact is the constraint to peak power production. The impact to irrigation is slight because of the infrequency of expected regulation against future irrigation water users.

Because impacts to wildlife, recreation and cultural environment are hard to define, anadromous fish has been used as an indication of these values in some parts of this document.

The alternatives that were evaluated in this program are no-action and seven combinations of the management options with various flow levels. A summary comparison of the alternatives is shown in Table 13 in the Program Document. Alternative E is the no-action alternative. Alternatives D and G offer a very high level of protection to fish and wildlife resources and have a significant impact on power. Alternative H is the proposed program.

I. PROPOSED ACTION

The Washington State Department of Ecology proposes implementation of the recommended program presented in the preceding program document. This program is known as the Columbia River Instream Resources Protection Program (CRIRPP).

Land-use regulation in the form of the Shoreline Management Act is an element of the proposed program. This is discussed in section IV.C.2.

II. EXISTING CONDITIONS

The preceding program document contains a brief overview of the existing conditions in the Columbia River basin. Additional information on existing conditions is presented in the discussion of the management options. From a practical viewpoint it would be impossible to include all information pertinent to the proposal without expanding this document to several volumes. Therefore, several excellent sources of information have been included by reference. These are referenced in Appendix A.

In order to present the environmental aspects of this proposal in the most understandable manner, the discussion in Section IV focuses on the management options available. Within each of these categories, existing conditions, alternatives, and impacts are presented.

III. IMPACT ANALYSIS

The analysis of the impacts associated with adopting an instream resource protection program is very complex. It is difficult to compare fish to megawatts and agricultural crops to recreational opportunities. To provide some means of comparison, the various benefits and impacts have been converted to dollars where possible. These dollars are intended to show "ball-park" values involved in the tradeoffs. They cannot account for all the social and cultural impacts.

A. Impacts of the Proposal.

The impacts of the proposal have been displayed in Tables 2 and 3. Table 2 gives a brief description of the impact of each program element on each program objective. Table 3 shows the economic impacts of the program on those objectives that can be quantified.

B. Impacts Which Can be Mitigated

The major adverse impact of this proposal is to hydroelectric power production. The only way this program could be modified to mitigate the impact to power production would be to establish lower minimum flow requirements. If this were done, less protection would be afforded to the other instream resources. This would not solve the problems now facing the fish and wildlife resources. Incorporated into the program is a means of "sharing the burden" in low water years which reduces the impact on power during critical flow years. This is the critical flow adjustment discussed on page 49.

Other means of mitigating the impacts on power production would be to use some other means of producing energy and/or to institute a strong conservation program. For example, the development of other energy sources would help to ease the impact of this program on hydroelectric power production while either a voluntary or mandatory conservation program should also be considered for the future as a means of alleviating power impacts.

C. Unavoidable Adverse Impacts

The unavoidable adverse impacts associated with this proposal are reduced power production, especially peak power production, and curtailed irrigation during extremely low water years. There is a mechanism in the program to reduce the flow requirements during low-water years, so that drought conditions will be shared to a greater degree than at present.

TABLE 2
Descriptive Summary of Impacts of the Proposal

Program Element	Fish and Wildlife	Recreation	Natural Environment	Navigation	Electric Energy	Flood Damage Reduction	Irrigation	Municipal and Industrial Water Supply
Establish Minimum Average Daily Flows	Benefits due to increased flows	Benefits due to increased flows. Reduced reservoir-oriented benefits	Benefits due to increased flows	Minimal benefits due to increased flows	Overgeneration losses. Reduced reservoir refill capacity	No impact	Losses to future water rights in extreme low flow years	No Impact
Establish Minimum Instantaneous Flows	Benefits due to more constant flows	Benefits due to more constant flows	Benefits due to more constant flows	Minimal benefits due to more constant flows	Overgeneration and peaking capacity losses	No Impact		No Impact
Establish Conservation and Efficiency Fundamentals	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows	Benefits due to slightly increased flows for power generation	No Impact	Requires more efficient irrigation water use	No Impact
Federal Project Authorization 1/ Changes	Benefits due to language modifications	No Impact	Benefits due to fish and wildlife benefits	No Impact	Impacts on power production depend on any changes in operation due to authorization language	No Impact	No Impact	No Impact
Federal Energy Regulatory Commission Licensing Provisions 1/	Benefits due to increased flows	Benefits due to increased flows	Benefits due to increased flows	No Impact	Reduced power generation flexibility	No Impact	No Impact	No Impact
Seek Volume of Water for Fisheries Interest 1/	Benefits due to water available for fish passage	Benefits due to increased fish and wildlife	Benefits due to increased fish and wildlife	No Impact	Impacts on power generation and operation flexibility	No Impact	No Impact	No Impact
Recommend Additional Storage 1/	Benefits due to flow augmentation. Impacts due to inundation	Benefits to lake-oriented recreation; loss of stream-oriented recreation	Change rivers into reservoirs, change river flow regime	No Impact	Benefits due to additional stored water available for power production	Possible benefits due to increased storage capacity	Benefits due to availability of more water during irrigation season	No Impact

1/ Actual impacts of these program elements depend on specific changes implemented.

TABLE 3
Summary of Economic Impacts of the Proposal 1/
(millions of 1977 $'s per year)

Program Element	Fish & Wildlife	Electric Energy	Irrigation
Minimum Average Daily Flow Minimum Instantaneous Flow	+34.4 to +59.4	-13.0 to -15.3	- - -
Federal Project Authorizations	Unknown (+)	Unknown (?)	- - -
Federal Energy Regulatory Commission Licensing	Unknown (+)	Unknown (-)	- - -
Volume of Storage for Fisheries Interests	- - - - - - - - - - - - - - - - - SEE NOTE 2/ - - - - - - - - - - - -		
Additional Storage	Unknown (?)	Unknown (+)	Unknown (+)
Control of Pool Fluctuation	No recommendations made at this time.		

Notes: 1/ Values taken from Tables 20, 23, and 24.

2/ No separate estimates were made for this program element. However, if the entire 2 million acre-feet were used for spill each year (an unlikely outcome), the values reported for Spill Option C would apply, i.e., +$4.1 to +9.0 million for fisheries; -$12.6 for electrical energy.

IV. MANAGEMENT OPTIONS AND IMPACTS

The following options were explored and evaluated as means to achieve the goals and objectives of the Columbia River Instream Resource Protection Program (see Section I of Program Document). The proposed program and alternatives are combinations of those options over which the Department of Ecology has control or authority. Not all of the options discussed in this section are under DOE's authority.

In many cases, the information on the management options discussed below was provided by other agencies such as the Washington Department of Fisheries, Washington Department of Game, the Corps of Engineers, the Bureau of Reclamation, and others. As a result, the department served as editor of this section rather than as principal author. In editing the materials, every effort was made to evaluate the information that was provided and to utilize the information as much as possible during development of the recommended program.

Table 1 of the Program Document shows the relationship of the management options to the program objectives. It may seem that the options evaluated are primarily for the benefit of anadromous fish. However, the anadromous fish is used as an indicator for the well-being of other equally important instream resources.

IV.A. STRUCTURAL MEASURES FOR FISH

A.1. Additional Storage in Tributary Areas

The Columbia River system has limited storage capacity and, therefore, limited operational flexibility. Additional reservoir storage capacity could be constructed on the tributary rivers to store water during high flow periods. This water could then be released in a controlled manner for the benefit of instream resources. The specific purposes a dam is to serve are spelled out in the authorization or license. If so specified, the stored water can be used for the maintenance of instream flow levels and/or the provision of spill at main stem dams during juvenile salmon migration. None of the eleven main stem dams currently has either of these provisions as a specified project purpose.

The Pacific Northwest River Basins Commission has identified 54 potential major storage sites in the Columbia River system. The sites would have a combined storage capacity of more than 47 million acre-feet.[1/] Many of these sites pose conflicts with existing uses of the sites and/or the environment and, therefore, do not represent realistic possibilities. Of the eight sites identified in the State of Washington, the most attractive because of size, location, and cost is Shankers Bend (1,800,000 acre-feet, Similkameen River), although Canada and some fish and wildlife agencies currently oppose this site.

1/ PNRBC, Water-Today and Tomorrow, Vol. III, p. 6-29, 6-30. Based on U.S. Army Corps of Engineers data.

Numerous other storage sites in addition to those noted above have been identified by various entities. Three studies of statewide scope are the Pacific Northwest River Basins Commission's Columbia-North Pacific Comprehensive Framework Study (1971), the Corps of Engineers' Summary of Northwest Hydroelectric Power Potential (1976), and the City of Seattle Department of Lighting's Potential Hydroelectric Developments – Report on Site Selection Survey (by R. W. Beck) (1977). A list of selected potential reservoir sites is presented in Table 4.

The Corps of Engineers also has identified a number of potential pumped storage projects in the Columbia River system. A very limited number of these projects, if operated on a seasonal basis, might contribute to the protection of instream resources by providing increased stream flows for fish migrations. However, the Columbia River Intertribal Fish Commission "is opposed to the construction and operation of pumped storage projects in any stretch of river used by anadromous fish for migration, spawning, and/or rearing because of associated fish losses and habitat destruction." The Department of Game has similar concerns because of potential impacts on waterfowl. Of the four seasonal pumped storage projects identified by the Corps of Engineers in the Pacific Northwest, three are in the State of Washington. A list of these projects is presented in Table 5.

TABLE 5
SEASONAL PUMPED STORAGE SITES

Site	Existing Lower Reservoir	Storage (acre-feet)
Omak Lake -Goose Flats	Lake Rufus Woods (Chief Joseph Pool)	700,000 or 4,700,000
Patterson Ridge	John Day Pool	3,000,000
Deadman	Little Goose Pool	1,000,000 to 3,000,000

Sources: U.S. Army Corps of Engineers North Pacific Division. Pumped Storage in the Pacific Northwest, An Inventory (CRT 26). January 1976. p. 49.

U.S. Army Corps of Engineers North Pacific Division. Columbia River and Tributaries Review Study – Planning Issues (CRT 27). February 1976. p. V-18.

The Corps' Seattle District is conducting a feasibility level study of two pumped-storage alternatives in the Omak Lake-Goose Flats area of the Colville Indian Reservation. The study was requested by the Colville Confederated Tribes. Alternative "1" would have 700,000 acre-feet of storage and would use Lake Rufus Woods as the lower reservoir. Alternative "2" would have 4,700,000 acre-feet of storage and would use the Okanogan River and Lake Rufus Woods as the lower reservoir. Both alternatives could generate 2,000 megawatts of peaking power. They could operate on either a weekly or seasonal cycle, depending on the type of peaking power needed, the availability of seasonal streamflows, the amount of pumping energy available, and the anticipated fluctuations in the lower reservoirs. The study was initiated in 1977 and is currently scheduled for completion in 1981.

TABLE 4
SELECTED POTENTIAL RESERVOIR SITES [1/]
State of Washington

Site	Stream	River Mile	Active Storage (acre-feet)	Approximate Construction Cost ($1,000,000)	Approximate Unit Cost [8/] of Storage ($/AF)
Curlew [2/]	Kettle	64 66.7 [4/]	157,000	60	382 [3/]
Orient [5/]	Kettle	16.5 23 [4/]	280,000	52 45 [2/]	185 [3/] 180 [3/]
Palmer Lake [2/]	Similkameen	15.8		91	
Nighthawk [2/]	Similkameen	14.4		70	
Shankers Bend [2/]	Similkameen	10 [5/] 7.3 [4/]	1,800,000 1,620,000 [4/]	159	88 [3/]
McLaughlin Falls [2/]	Okanogan			70	
Cow Creek [2/]	Chewack (Methow)	16 [5/]	797,000	220	[3/]
Pateros [2/]	Chewack (Methow)	5 [5/]		30	
Lucerne [5/]	StehekinLake Chelan		24,000	38 31 [2/]	1583 [3/] 1291 [3/]
Mile 1-14 [2/]	Entiat	3 [5/]		57	
Plain [2/]	Wenatchee	45.7	1,160,000	285	245 [3/] 117 [4/]
Leavenworth [5/]	Wenatchee	20		775	
Peshastin [5/]	Wenatchee	14		100	
Chiwawa [2/]	Chiwawa (Wenatchee)	11 [5/] 11.9 [4/]	205,000	96	468 [4/] 228 [4/]
Dirty Face Mountain	Chiwawa (Wenatchee)	8			
Monitor [5/]	Wenatchee	1			
Beacon Hill [2/]	Wenatchee				
8-Mile Creek [5/]	Icicle Creek (Yakima)	5			
Fortune Creek [2/]	Cle Elum (Yakima)	13 [5/]		1,292	
Fork [4/] (Casland [6/])	Teanaway (Yakima)	12	52,000		252
Teansway [4/]	Yakima	163 170.5 [6/]	190,000 160,000 [6/]		315
Squaw Creek [7/]	Squaw Creek (Yakima)		300,000	158	527 [3/]
Toppenish-Simcoe [7/]	Simcoe Creek (Yakima)		59,600	26	436 [3/]

TABLE 4 (Continued)

Site	Stream	River Mile	Active Storage (acre-feet)	Approximate Construction Cost ($1,000,000)	Approximate Unit Cost [8/] of Storage ($/AF)
Ellensburg [4/]	Yakima	139	215,000 150,000 [6/]		163
Canyon [6/]	Yakima		150,000		
Roza [4/]	Yakima	123	190,000		425
Little Naches [7/]	Naches (Yakima)		94,500	20	212 [3/]
Pleasant Valley [4/]	American (Yakima)	10	73,000 130,000 [6/] 533,000 [2/]	 825	140 1548 [3/]
Bumping Lake Enlargement [6/]	Bumping (Yakima)	16.1	424,000 (new)	148	349 [3/]
Little Rattler [6/]	Rattlesnake Creek (Yakima)	1.5	80,000		
Rattlesnake [7/]	Naches (Yakima)		68,000	48	707 [3/]
Ahtanum [7/]	Ahtanum Creek (Yakima)		57,000	32	561 [3/]
Horseshoe Bend [6/]	Naches (Yakima)	22(est.)	130,000		
Satus Creek [7/]	Satus Creek (Yakima)	15	80,000	25	312 [3/]
Wenaha [2/]	Grande Ronde	27	900,000	320	355 [3/]
Narrows [5/]	Grande Ronde	9	38,000	45	1184 [3/]
China Gardens [5/]	Snake	172	Pondage	387 [2/]	
Asotin [5/]	Snake	189	365,000	347 580 [2/]	950 [3/] 1589 [3/]

1/ Columbia River system above the Dalles Dam. The principal information source used for each site is identified by the footnote to the site name; supplemental sources are identified by other footnotes.

2/ U.S. Army Corps of Engineers North Pacific Division. Columbia River and Tributaries Review Study - Summary of Northwest Hydroelectric Power Potential (CRT 28). May 1976. Costs shown are total project costs including power plant using 1975 price levels.

3/ Calculated.

4/ Pacific Northwest River Basins Commission. Columbia - North Pacific Region Comprehensive Framework Study Appendix VII-Flood Control. June 1971. p. 105, 126-127, 219.

5/ R. W. Beck and Associates. Potential Hydroelectric Developments - Report on Site Selection Survey (for City of Seattle Department of Lighting). July 1977. Tables II-1 and II-2.

6/ U.S. Bureau of Reclamation Pacific Northwest Region Bumping Lake Enlargement, Yakima Project, Washington, Draft Environmental Impact Statement. February 1977. p. 10, 109-114.

7/ Washington Department of Ecology, Yakima River Basin Water Enhancement Project. 1979. Costs are 1978 dollars.

8/ Extreme caution should be exercised in interpreting this column. The figures shown are extremely crude approximations based on "reconnaissance level" information only. Figures from differing sources are based on differing price levels and therefore may not be comparable.

Douglas County PUD is presently studying two pump storage sites. The Browns Canyon pump storage site is about six miles north of Waterville, Washington. It would pump water from Lake Entiat to a man-made reservoir on the Waterville Plateau. Lift would be 2,400 feet. Electrical capacity would be 1,000 to 3,000 megawatts.

The second pump storage site under consideration would utilize existing facilities of the Greater Wenatchee Irrigation District. Water would be pumped from the Rock Island reservoir to a proposed new storage reservoir using an existing irrigation pipeline along Union Avenue which in part borders Pangborn Field, the Wenatchee airport. Electric capacity would be approximately 5 megawatts.

A.1.a. Existing Conditions

Existing seasonal storage reservoirs in the Columbia River system have an active storage capacity of approximately 43.5 million acre-feet (see Table 6). This represents approximately one-fourth of the average annual undepleted runoff of 180 million acre-feet at the mouth. Of the 43.5 million acre-feet storage capacity, approximately one-half is located in Canada. The 5.7 million acre-feet storage capacity in Washington is comprised of Grand Coulee Dam (Franklin D. Roosevelt Lake – 5,230,000 acre-feet) and John Day Dam (located on WA-OR border – 500,000 acre-feet). Neither of these projects has storage dedicated to the protection of instream resources.

A.l.b. Alternatives and Impacts

Construction of a storage reservoir at any of the sites listed in Table 4 would have adverse impacts on the environment. A dam could create passage problems for anadromous fish and inundate spawning and rearing areas. Wildlife habitat would be destroyed. Railroads and roadway would have to be relocated. Existing uses of the sites, such as farming or recreation, would be eliminated. During initial filling of a reservoir, downstream flows would be decreased.

On the other hand, the benefits of constructing additional storage reservoirs would be numerous. There could be the benefits of flood control, increased hydropower production, irrigation, recreation, maintenance of instream flow levels, and provision of spill for passage of downstream migrant fish.

Each site would have to be investigated for environmental impacts during the planning stages of the project.

The most attractive new storage reservoir site in Washington is the Similkameen River. This site is attractive because of location, size, and cost. If storage is constructed on the Similkameen River, it would be a multi-purpose project to provide instream flows, recreation, flood control, irrigation, and hydropower. The projected storage volume is 162,000 to 1,800,000 acre-feet, depending upon whether the water would be backed up into Canada.

TABLE 6
Existing Storage Elements of the Columbia River Systemic

Project	Reservoir Name	River	Location	Owner	Active Storage	Year of Initial Filing
					1,000 ac-ft	
Mica [2/]	McNaughton Lake	Columbia	BC	BC Hydro	12,000	1973
Keenleyside [2/]	Arrow Lakes [3/]	Columbia	BC	BC Hydro	7,100	1968
Duncan [2/]	Duncan Lake	Duncan	BC	BC Hydro	1,350	1967
Libby [2/]	Lake Koocanusa	Kootensa	MT	USCE	4,965	1972
Corra Linn	Kootenay Lake [3/]	Kootenay	BC	W. Kootenay P&L	450	1932
Hungry Horse		S.F. Flathead	MT	USBR	2,980	1951
Kerr	Flathead Lake [3/]	Flathead	MT	Mont. Power	1,220	1938
Noxon Rapids		Clark Fork	MT	Wa. Water Power	230	1959
Albeni Falls	Lake Pend Oreille [3/]	Pend Oreille	ID	USCE	1,155	1955
Grand Coulee	F.D.R. Lake	Columbia	WA	USBR	5,230	1938
Jackson Lake-Palisades		Snake	Wy-ID	USBR	1,600	1916-56
Boise River Reservoirs		Boise	ID	USBR/USCE	990	1914-56
Cascade-Deadwood		Payette	ID	USBR	815	1930-47
Brownlee		Snake	ID/OR	Idaho Power	980	1958
Dworshak		N.F. Clearwater	ID	USCE	2,000	1972
John Day	L. Umatilla	Columbia	WA/OR	USCE	500	1968
				TOTAL	43,565	

1/ This list excludes storage on the Cowlitz, Lewis, Willamette, Deschutes, Owhyee, Yakima, Chelan, - and Spokane rivers as well as numerous small reservoirs throughout the basin.

2/ Columbia River Treaty project.

3/ Natural Lake with storage control.

Source: U.S. Army Corps of Engineers, CR&T 27, February 1976, p. V-13. Columbia River Water Management Group.

The impacts associated with this project include flooding between 9,000 and 18,000 acres of primarily grazing land. The small community of Nighthawk would have to be relocated along with country roads and railroads. Some mines in the area would be inundated. A study is needed to determine what effects the proposed dam and reservoir would have on the fish and wildlife resources and habitat of the Similkameen Basin. Several fish and wildlife agencies oppose the project. Canyon slopes and valley bottoms provide important wintering habitat for big game in mild winters, and critical spring range after severe winters. In addition, important riparian habitat that provides excellent cover for upland game, raptors, and songbirds would be inundated. The Similkameen River also contains excellent habitat for anadromous fish runs. This potential would be destroyed if the High Shanker's Bend project were constructed.

A.2. Fish ladders

Fish ladders (Figure 1) are necessary to pass adult fish above barriers. On the Columbia River, all main stem dams have fish ladders up to Chief Joseph. On the Snake River, the lower four mainstem dams are equipped with fish ladders. Table 7 shows the number of ladders at each dam.

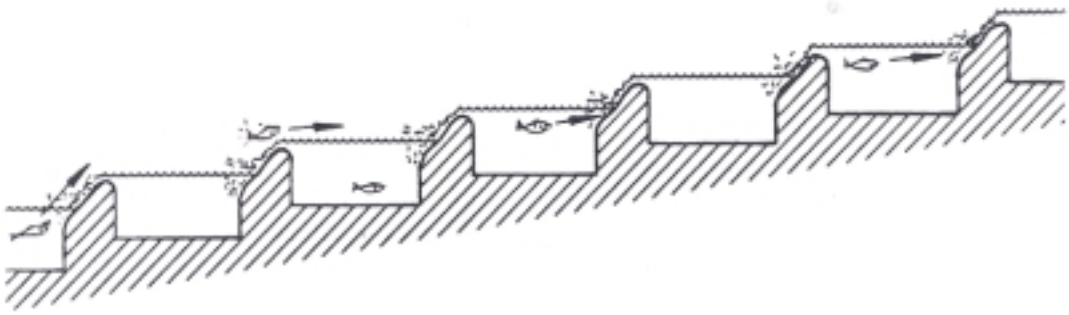


Figure 1. Fish Ladder

A.2.a. Existing Conditions

The ladders now in use are generally considered efficient, and quite successful in passing adult salmon and steelhead. If fish start up the ladder, they will generally complete their journey. However, fallback (see Appendix E) at Bonneville Dam was found to be a significant problem during the spring chinook and early summer chinook migration when heavy spill occurred. Numerous methods were tried to prevent this fallback but they were largely unsuccessful. Fallback has also been found to occur on several of the Snake River Dams and at Rocky Reach Dam but it was not considered significant. With the present control and regulation of the river and the drastic reduction in spill, fallback is not considered to be a major problem in the future.

According to the Washington Department of Fisheries, the south shore ladder on John Day Dam has a poorly located entrance, making it difficult for adult fish to find. Adult shad were once blocked at Ice Harbor and Lower Monumental Dams because of the type of ladder exit. The U.S. Army Corps of Engineers scheduled completion of modifications to these ladders in 1979. The modification would allow shad passage, however, as a result of Idaho Fish and Game

TABLE 7
Columbia and Snake River Dams With Fish Ladders,
Types of Forebay Flow Control, and Forebay and Tailrace Operating Evaluations

	Number of Ladders	Type of Forebay Flow Control	Tailwater Elevation 1/ Min.	Tailwater Elevation 1/ Max.	Forebay Elevation 1/ Min.	Forebay Elevation 1/ Max.
COLUMBIA						
Bonneville	3	Vertical Slot	8	–	72	74
The Dalles	2	Adjustable Weir	74	83.9	158	160
John Day	2	Vertical Slot	158	165	262	266
McNary	2	Tilting Weirs	262	270	336	340
Priest Rapids	2	Orifice	401	413	481.5	486.5
Wanapum	2	Orifice	483	493	560	570
Rock Island	3	Orifice	560	575	604	607.5
Rocky Reach	1	Orifice	607	618	703.8	710
Wells	2	Orifice	705	715	771	779
SNAKE						
Ice Harbor	2	Orifice	339	349	437	440
Lower Monumental	2	Orifice	437.5	445	537	540
Little Goose	1	Orifice and vertical slot	537	541.5	633	638
Lower Granite	1	Orifice and vertical slot	633	639.7	733	738

1/ Feet above mean sea level

Source: Washington State Department of Fisheries

Department Policy, a removable barrier wier was constructed at the base of the Ice Harbor ladders to prevent shad from entering the ladder. That Department wants to study the effects of shad on other fishery resources before approving the passage of shad into the Snake River system. American shad, a nonsalmonid anadromous species now very abundant in the lower main stem Columbia is native to the Atlantic Coast of North America and was introduced to the Pacific Coast in the 1870's.

A.2.b. Alternatives and Impacts

There are limited alternatives available to aid in the protection of instream resources through the use of fish ladders. These alternatives include 1) "no action," 2) modifying existing ladders, and 3) constructing new ladders on the tributaries, opening up additional spawning areas. The "no action" alternative has no beneficial or adverse impacts as the existing system is generally adequate to move adult fish past the dams. Any improvement of existing ladders will benefit the anadromous fisheries, with the main adverse impact being the construction cost of modifications. Construction of new fish ladders on tributaries is currently being studied and carried out where possible. The benefits of this alternative are increased spawning area and increase fish runs. The adverse impacts are the cost of construction and use of water for ladder operation instead of potential power production.

A.3. Turbine Screens and Bypass Systems

Submersible traveling screens are mechanical fish-guiding devices used at three main stem Columbia and Snake River dams to prevent downstream migrants (juvenile fish) from entering turbines where excessive mortalities are incurred. The screens divert the juvenile migrants into a bypass system to safely pass around the dam. Figure 2 shows a sectional view of a powerhouse with a traveling screen and fish bypass conduit.

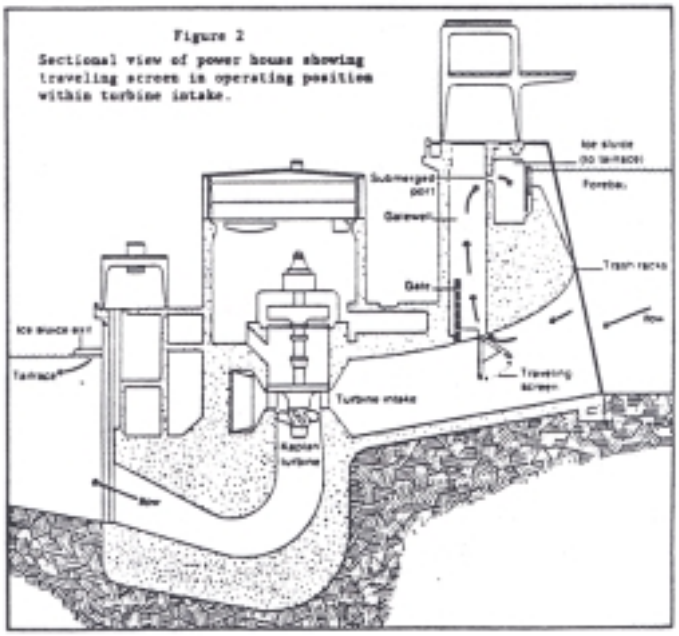


Figure 2

A.3.a. Existing Conditions

All turbine units have been screened at Lower Granite and Little Goose Dams on the Snake River. Two units have been screened at McNary Dam on the Columbia River. These units have been screened in order to continue research and in order to collect migrants for juvenile transportation and homing studies. Refer to section IV.B.1 for more information on transporting fish around dams.

The screens are effective in diverting approximately 60 percent of the juveniles from entering the turbines during a low flow year. The remaining 40 percent are not diverted and must still pass through the turbines. The average mortality rate for fish that pass through the turbines is 15 percent per dam although this figure varies at different projects. Assuming this 15 percent average mortality rate, the total mortality rate is 77 percent after nine dams, when there is no spill. The average mortality rate for a screen and bypass system, however, is estimated at only a 7 percent per dam. The total mortality rate for this system is reduced to 48 percent after nine dams. These rates are due to dam passage only and do not take into account other factors affecting fish survival.

Turbine screens have not yet been perfected. The screens are expensive to construct and install and are subject to mechanical failures. Not all fish can be diverted and those that are diverted are subject to stresses and subsequent mortality. Research is continuing on mechanical-type screens as well as nontraveling bar screens for guiding juveniles out of turbine intakes. The test results at McNary Dam show promising results for perfecting turbine screens. Construction of screens and bypass systems at other main stem dams has been deferred until they have been perfected. See Figure 3 for the Corps of Engineers' tentative program.

Another method of passing juvenile salmonids around the turbines is to use the ice and trash sluiceways. A surface attraction is provided in the forebay by opening the sluiceway gates immediately above the turbines which tend to pass the most fish. This method has passed up to 70 percent of the downstream migrants around The Dalles Dam and is being tested at Bonneville Dam.

The existing mid-Columbia PUD dams do not have either built in fish bypass conduits or ice-trash sluiceways. The new Rock Island powerhouse will have a fish bypass conduit.

Douglas County PUD reports very high survival rates for fish passing through the turbines at Wells Dam. They feel that this is due, in part, to the design of the turbine which minimizes cavitation and thus the pressure shock experienced by the fish although the U.S. Fish and Wildlife service reports that "the Columbia River fisheries agencies disagree with the experiments used to reach this position."

A.3.b. Alternatives and Impacts

The alternatives to screening and bypassing include: (1) "no action;" (2) screen and transport; and (3) provisions for spill over the dams to pass juveniles.

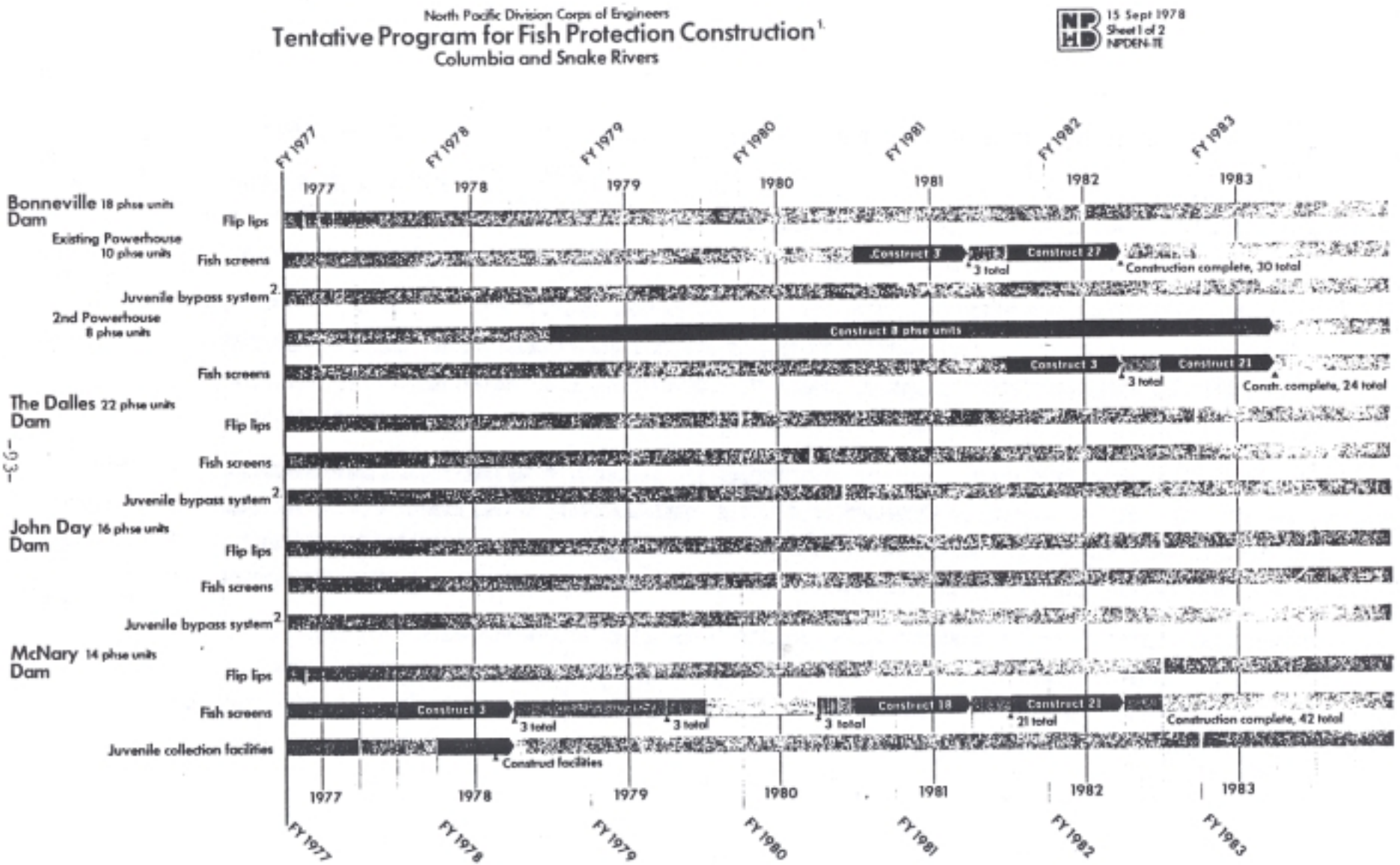
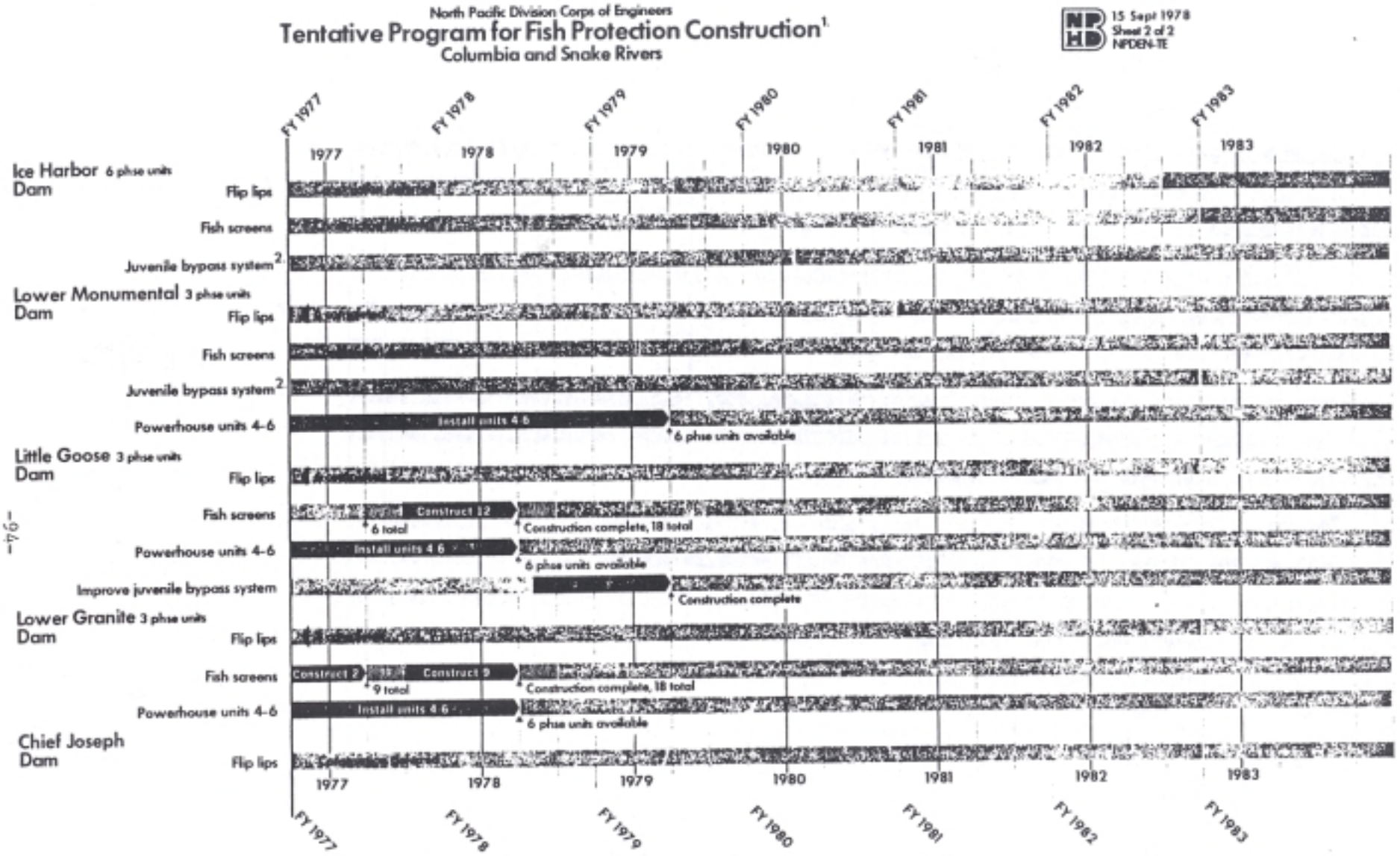

North Pacific Division Corps of Engineers
Tentative Program for Fish Protection Construction[1]
Columbia and Snake Rivers
15 Sept 1978
Sheet 1 of 2
NPDEN-TE
FY 1977
FY 1978
FY 1979
FY 1980
FY 1981
FY 1982
FY 1983
1977
1978
1979
1980
1981
1982
1983
Bonneville Dam 18 phse units
Flip lips
Existing Powerhouse 10 phse units
Fish screens
Construct 3
3 total
Construct 27
Construction complete, 30 total
Juvenile bypass system[2]
2nd Powerhouse 8 phse units
Construct 8 phse units
Fish screens
Construct 3
3 total
Construct 21
Constr. complete, 24 total
The Dalles 22 phse units Dam
Flip lips
Fish screens
Juvenile bypass system[2]
John Day 16 phse units Dam
Flip lips
Fish screens
Juvenile bypass system[2]
McNary 14 phse units Dam
Flip lips
Fish screens
Construct 3
3 total
3 total
3 total
Construct 18
21 total
Construct 21
Construction complete, 42 total
Juvenile collection facilities
Construct facilities
-93-

Figure 3



Notes: 1. Formerly entitled "Tentative Program for Reducing N_2Effects".
2. Schedule for bypass work to be developed based on results of on results of ongoing studies and research.
3. Flip lip construction now deferred to be re-evaluated based on data obtained the next few years.

Figure 3 (continued)

The "no action" alternative is already seen in the existing system with high mortality rates. This alternative awaits completed research by the Corps of Engineers as well as the installation of screens and bypasses at various dams. The major impact under the "no action" alternative is the high mortality rates that will occur (a total of 77 percent) for downstream migrants before bypasses are installed. The fishery agencies feel that the 77 percent mortality rate could wipe out the anadromous fishery resource in the Columbia River.

The alternative of screening the turbine intakes, collecting the downstream migrants, and transporting them past the dams is discussed in more detail in section IV.B.1. In general, this alternative has not been proven effective on a large scale. At this time, the fisheries agencies, both state arid federal, consider artificial transportation of fish to be an unacceptable alternative for moving fish past dams on a regular basis.

The Washington State Department of Fisheries report that trapping and hauling is considered a stop-gap emergency measure until such time as it has been definitely proven that successful results can be achieved. Recent results of small groups of transported chinook and steelhead from the Snake River have shown good benefits for the steelhead and only fair benefits for the chinook transport. During the 1977 low flow year, mass transportation from the Snake River was initiated in an effort to save the fish. Approximately 1,296,600 chinook smolts and 903,400 steelhead smolts were either trucked or barged from Lower Granite Dam. The two ocean spring chinook from this program returned in 1979. A total of 9,247 were counted at Ice Harbor Dam with an effective spawning population of 6,955 recorded at Lower Granite Dam. Spring chinook smolts from the Middle Columbia River were not transported during 1977. The two ocean spring chinook runs return to Priest Rapids Dam in 1979 was 7,750 fish with an effective spawning population of 6,548 recorded at Rock Island Dam. These initial returns from the first year of mass transport from the Snake River, as compared to Mid Columbia nontransported fish, do not indicate a successful program.

The alternative of spilling water over the dams to pass downstream migrants is preferred by the fisheries agencies to transportation. The cumulative mortality rate for passage at 9 dams is approximately 17 percent (2 percent per dam). The adverse impact associated with this alternative is the spilling of water instead of using it to generate power. The current recommendations from the Columbia River Fisheries Council would require a spill of approximately 7 million acre-feet which would generate approximately 7,900,000 megawatt-hours of electricity or approximately 6 percent of the total system load in 1977. Current operations spill about 10 percent of CRFC total recommendations.

It should be noted that while the fisheries agencies feel that the provision of spill to pass fish is the best alternative available now, any other proven means of providing safe and effective passage of fish would also be an acceptable alternative.

A.4. Spillway Deflectors

Once recognized as a major river problem, nitrogen supersaturation has occurred at Columbia and lower Snake River projects, resulting in an estimated high mortality of downstream migrants and in an unknown mortality to adult fish. It occurs when excessive air is entrained (drawn) in the water falling over the spillways, continuing into the deep basin below. The gaseous nitrogen and the other gases of the air dissolve in the water under pressure. As the water returns to the surface downstream from the spillways, it reaches a supersaturated condition. Fish take in the excess gas which then passes through the body tissue and circulatory system, causing bubbles to appear on the gills and under the skin when the fish approach the surface (gas bubble disease). This can directly result in death to the fish or create open sores which are subject to infection.

During periods of heavy spill, levels of dissolved gases of 135 to 140 percent of saturation were measured between the main stem dams of the Columbia and Snake Rivers. This is well above critical thresholds for both adult and juvenile salmon and steelhead. There is ample evidence, both in laboratory and field studies, that adult and juvenile salmon and steelhead are jeopardized by gas bubble disease in the Columbia River Basin. The severity of the disease and its consequences depend on the level of super-saturation, duration of exposure, water temperature, general physical condition of the fish, and the swimming depth maintained by the fish.

Many techniques have been investigated in an attempt to control super-saturation. Spillway deflectors (flip lips) have provided the best means of controlling super-saturation devised so far. By providing a lip at the end of the spillway, the spilled water is spread out along the surface of the stilling pond rather than plunged to a supersaturating depth. (See Figure 4.)

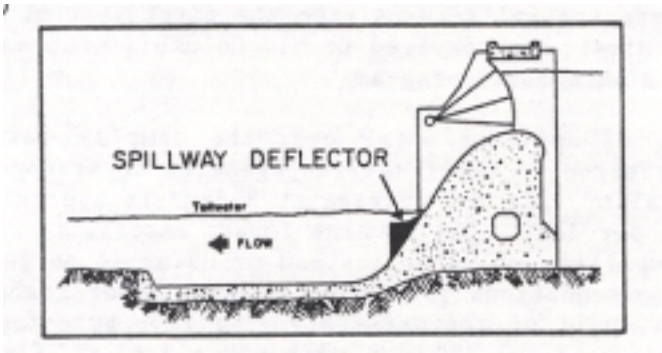


Figure 4. Spillway Deflector

A.4.a. Existing Conditions

Flip lips have been installed at Bonneville and McNary Dams on the Columbia River and Lower Monumental, Little Goose and Lower Granite dams on the Snake River. Construction has been deferred at other main stem dams (see Figure 3) because of increased storage, regulation of the river, and increased powerhouse hydraulic capacity. These reduce the amount of water that must be spilled for normal operation.

The recommendations of the Columbia River Fisheries Council for spill volumes at each dam will result in nitrogen levels ranging from 110 percent to 120 percent of saturation. These levels are not expected to result in excessive adult or juvenile salmonid mortality.

A.4.b. Alternatives and Impacts

There are no real alternatives, as the hydraulic capacity of the powerhouses will soon allow most of the water to pass through the turbines instead of over the spillways. The spill that is recommended for fish passage does not raise the super-saturation levels enough to warrant the installation of additional deflectors.

A.5. Hatcheries and Spawning Channels

Historically, all salmon and steelhead were wild fish produced in the natural stream environment. Today, artificial production accounts for over 50 percent of all fish returning to the Columbia River system.

Hatcheries have an important place in fishery management. In recent years, their efficiency has been greatly increased by better knowledge of fish requirements. Improvements in fish cultural methods have been made in the following areas: ponds, rearing procedures, and fish disease prevention and control. These have resulted in higher growth and survival rates.

Modern hatcheries have several valuable functions: (1) mitigating fish losses caused by man-made barriers to natural spawning areas and/or diversion of stream flows for other uses; (2) maintaining and increasing fish stocks over-exploited by commercial and sport fishing; (3) mitigating fish losses due to pollution or alteration of the natural environment; (4) stocking of rehabilitated habitat areas where fish have been eliminated or depleted, due to adverse conditions, or stocking of new areas previously usable because of obstructions; (5) enhancement of production in areas where natural production potential (rearing capacity) is not realized; and (6) introduction of species more suitable to an altered environment (e.g. warm-water or pan fish to certain reservoir areas).

A.5.a. Existing Conditions

Hatchery production of Pacific salmon in the Columbia Basin includes chinook, coho, and chum. The best results are obtained with coho and fall chinook salmon. Spring chinook are now being successfully handled in limited areas. Some kokanee (landlocked sockeye) eggs also are taken at a few locations for lake and reservoir stocking.

Salmon and steelhead production hatcheries within the Columbia Basin are operated by four state fisheries agencies (Washington Department of Game, Washington Department of Fisheries, Oregon Department of Fish and Wildlife, and Idaho Department of Fish and Game) and one federal agency (U.S. Fish and Wildlife Service). However, financial support for these hatcheries is more broadly based and often draws from other public or private sources, such as the U.S. Army Corps of Engineers, National Marine Fisheries Service, and hydropower companies. Table 8 and 9 show 1977 hatchery production and future hatchery production with compensation programs as proposed by the above noted agencies.

TABLE 8

Number of pounds of salmon and steelhead released into Columbia River and tributaries above Bonneville Dam in 1977.

	USFWS		WDF		WDG		IDF&G		ODFW		TOTAL	
Species	No.[1/]	Pounds [2/]	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Spring Chinook	9,740	321,744	1,070	117,375	000	000	5,785	248,222	238	4,468	16,833	691,809
Summer Chinook	311	27,872	894	31,686			247	6,650	118	4,862	1,570	71,070
Fall Chinook	32,821	371,978	2,985	30,497							35,806	402,475
Coho	6,414	316,375	2,814	152,367						961	785	10,189
Steelhead	5,564	272,592			861	153,251	2,127	283,435 727	57,454	9,279	766,732	
TOTAL	54,850	1,310,561	7,763	331,925	861	153,251	8,159	538,307	2,044	67,569	73,677	2,401,613

1/ Numbers in thousands

2/ Pounds are actual

USFWS U.S. Fish and Wildlife Service
WDF Washington Department of Fisheries
WDG Washington Department of Game
IDF&G Idaho Department of Fish & Game
ODFW Oregon Department of Fish and Wildlife

Source: Washington Department of Fisheries

TABLE 9

Summary of the present (1977) production program (smolts) and proposed compensation program (smolts)1/

	PRESENT PROGRAM in 1977		PROPOSED COMPENSATION PROGRAMS		TOTAL	
Species	Number	Pounds	Number	Pounds	Number	Pounds
Spring Chinook	16,833,000	691,809	29,595,000	1,973,000	47,998,000	2,735,879
Summer Chinook	1,570,000	71,070				
Fall Chinook	35,806,000	402,475	16,180,000	179,800	51,986,000	582,275
Coho	10,189,000	469,527	4,695,000	313,000	14,884,000	782,527
Steelhead	9,279,000	766,732	16,420,000	2,052,500	25,699,000	2,819,232
Sockeye			2,025,000	135,000	2,025,000	135,000
TOTAL	73,677,000	2,401,613	68,915,000	4,653,000	142,592,000	7,054,913

1/ "Species substitution may be implemented in proposed compensation programs for salmon. For example, rather than produce 135,000 pounds of sockeye, some other species may be reared at a similar level.

Source: Washington Department of Fisheries ,

In essence, the purpose of hatchery programs in the basin is to help maintain or add to our salmon and steelhead resources and to attempt to compensate for loss of former high rates of natural production. The specific purpose of each hatchery is summarized in Table 10.

Hatcheries, although they do have an important place in fishery management, do not provide a total solution to the Columbia River dilemma. There are many unanswered questions associated with heavy reliance on hatchery production. The fishery agencies are concerned about the effect on the wild stock of having high numbers of hatchery fish mixed with limited wild stock in the ocean harvest. Hatchery fish have a higher fry survival rate (90 percent) than wild fish (10 percent) and therefore, need far fewer returning adults to sustain the species. However, there is no way to segregate the wild stock from the hatchery stock during harvest in order to maintain the necessary percentages of each in the escapement.

Another result of hatchery production is increased disease rates due to more crowded conditions in hatcheries. In hatcheries, there are also large accumulations of eggs in one place, with the resultant susceptibility to total loss due to disease, sabotage, or environmental conditions such as contaminated water or frozen water supplies.

A.5.b. Alternatives and Impacts

The alternatives investigated are: (1) maintain current conditions; (2) construct and operate the hatchery facilities in the proposed compensation program; and, (3) construct facilities in addition to those in the proposed compensation program.

Under current conditions, only lower river coho and fall chinook are maintaining a harvestable run size. The upriver races of salmon are declining even under no-harvest conditions. The upriver races of salmon provide extensive ocean and limited in-river harvest. Currently, the harvest of spring and summer chinook occurs mainly in the ocean. Upriver fall chinook continue to be harvested in the ocean, lower river, and upper river. The proposed compensation programs were designed to replace losses of upriver stocks resulting from dam operations. These facilities will be located in the mid-Columbia and Snake River drainages and will return adults to these areas. Maintenance of current conditions may not be a feasible alternative since compensation programs are already planned which are intended to improve existing conditions.

There are additional compensation plans presently under study. These include the Grand Coulee Phase II Program, Lower Snake Enhancement, Lower Snake Fish and Wildlife Compensation Plan, Lower Columbia Compensation, Plan, and McNary Second Powerhouse Compensation. The two prime limiting factors are money availability and the scarcity of hatchery sites with acceptable water sources.

TABLE 10
Purpose of Anadromous Fish Hatchery Programs In Columbia Basin

Source: Pacific Northwest Regional Commission. Investigative Reports of Columbia River Fisheries Project. July 1976

	Enhances Conserve Run	Develop New Run	Restore to mitigate lost run	Research		Enhances Conserve Run	Develop New Run	Restore to mitigate lost run	Research
Washington Hatcheries					Washington Hatcheries (Continued)				
Lewis River					Elokomin				
Spring chinook					Fall chinook			X	
Coho			X		Coho			X	
Wells					Grays River				
Summer chinook	X				Fall chinook			X	
Rocky Reach					Coho			X	
Coho		X	X		Chum			X	
Priest Rapids					Kalama Falls				
Fall chinook					Spring chinook			X	
Speelyai					Fall chinook			X	
Coho			X		Coho			X	
Spring chinook			X		Columbia Basin Hatchery				
					Summer steelhead			X	
Lower Kalama					Beaver Creek Hatchery				
Fall chinook					Sea-run cutthroat			X	
Coho			X		Winter steelhead			X	
Cowlitz					Skamania Hatchery				
Spring chinook			X		Summer steelhead			X	
Fall chinook			X		Ringold Rearing Pond				
Coho			X		Summer steelhead			X	
Washougal					Cowlitz-Swofford Hatchery				
Fall chinook		X			Sea-run cutthroat			X	
Coho	X				Summer steelhead			X	
					Winter steelhead			X	
Ringold					Chelan P.U.D. Hatchery				
Spring chinook	X				Summer steelhead	X		X	
Fall chinook	X								

TABLE 10 (Continued)
Purpose of Anadromous Fish Hatchery Programs In Columbia Basin

	Enhances Conserve Run	Develop New Run	Restore to mitigate lost run	Research		Enhances Conserve Run	Develop New Run	Restore to mitigate lost run	Research
Washington					Washington				
Hatcheries					Hatcheries (Continued)				
Klickitat					Winthrop NFH			X	
Spring chinook		X			Vancouver Hatchery				
Fall chinook		X			See-run cutthroat	X			
Coho					Steelhead			X	
Toutle					Wells Hatchery				
Fall chinook			X		Summer steelhead			X	
Coho			X						
					Idaho Hatcheries				
Naches Hatchery					Pahsimeroi Rearing Ponds				
Summer steelhead	X				Summer chinook	X			
Yakima Hatchery					Niagara Springs Hatchery				
Summer steelhead	X				Summer steelhead			X	
Tucannon Hatchery					Decker Pond				
Summer steelhead	X				Spring chinook	X			
Abernathy Salmon Cult-					Rapid River Hatchery				
ural Development Ctr					Spring chinook			X	
Fall chinook	X			X	Hayden Creek Research				
Carson NFH					Station				
Spring chinook			X		Spring chinook	X		X	
Entiat NFS					Summer steelhead	X		X	
Spring chinook			X		Dworshak NFH				
Summer chinook			X		Summer steelhead			X	
Leavenworth NFH					Kooskia NFH				
Spring chinook			X		Spring chinook	X		X	
Little White Salmon -					Various (Columbia River				
Willar NFH					Program)				
Spring chinook			X		Spring chinook			X	
Fall chinook			X		Summer steelhead			X	
Coho			X						
Spring Creek NFH									
Fall Chinook			X						

TABLE 10 (Continued)
Purpose of Anadromous Fish Hatchery Programs In Columbia Basin

	Enhances Conserve Run	Develop New Run	Restore to mitigate lost run	Research
Oregon				
Hatcheries				
Big Creek Salmon Hatchery				
Fall chinook	X		X	
Coho	X		X	
Winter steelhead	X	X	X	
Bonneville Salmon Hatchery				
Fall chinook	X		X	
Coho	X		X	
Cascade Salmon Hatchery				
Coho	X		X	
Gnat Creek Hatchery				
Summer steelhead	X		X	
Winter steelhead	X		X	
Klaskanine Salmon Hatchery				
Fall chinook	X		X	
Coho	X		X	
Winter steelhead	X	X	X	
Marion Forks				
Spring chinook	X		X	
Winter steelhead	X		X	
Mackenzie				
Spring chinook	X		X	
Oregon				
Hatcheries (Continued)				
Oak Springs Hatchery				X
Summer steelhead	X			
Oxbow Salmon Hatchery				X
Fall chinook	X			X
Coho	X			
Round Butte Hatchery				
Spring chinook	X			X
Summer chinook	X			X
Summer steelhead	X			X
Sandy River Salmon Hatchery				
Spring chinook	X			X
Fall chinook	X			X
Coho	X			X
South Santiam				
Spring chinook	X			X
Summer steelhead		X		
Wahkeena Pond				
Coho	X			X
Willamette				
Spring chinook	X			X
Willamette Ponds				
Fall chinook		X		

For any of these alternatives to be successful, it is essential that safe passage be provided at the various hydroelectric projects for the millions of juvenile migrants that must pass them on their way to the sea.

IV.B. NONSTRUCTURAL MEASURES FOR FISH

B.1. Transport Fish Around Dams

The technique of artificially moving juvenile salmon and steelhead to the sea has been well publicized. The fish are collected at the uppermost Corps dams on the main Snake River and trucked or barged for release below Bonneville Dam. This collection and transportation has proven valuable as an emergency measure awaiting substantial improvement of the serious passage problems at Columbia River main stem dams. Transportation by truck, barge, or plane reduces losses of juveniles from turbines, nitrogen super-saturation, pollution, predation, and delayed migration.

B.l.a. Existing Conditions

According to the fishery agencies, it appears that collection and transportation of juveniles holds promise as a management tool, but is not a cure-all for downstream migration problems. Experience on the Snake River indicates that collection and transportation is beneficial in low flow years. However, if flows are too low, such as in 1977, a majority of the juveniles may residualize or be killed before they can reach collection points at Lower Granite and Little Goose dams. Under such conditions, flow supplementation is needed to insure that fish reach transport points.

To date, steelhead smolts appear to suffer less mortality than do chinook from transportation and handling stresses. However, limited return data indicates that transported steelhead tend to stray. Experimentation to prevent injury of juveniles by the collection process, to minimize stress induced mortality from handling and transportation, and to assess the effects of transportation on homing is not complete. In its comment, the Corps of Engineers stated, "Return data has shown that one group which may have not been imprinted sufficiently did stray. However, the majority of the fish are returning to their parent stream." None of the turbines at the five PUD dams on the mid-Columbia River is designed to permit collection of juveniles, with the exception of the turbines of a second powerhouse now being constructed at Rock Island Dam.

In summary, artificial transportation may show limited utility as a management option, but it does not appear that it will ever replace the natural smolt migration made possible by the provision of safe passage at the dams. In its letter, the Corps stated, "We agree with the statement . . . that transportation will not replace natural migration. However, it must be recognized that transportation is the best alternative available at this time and comes much closer to duplication of pre-dam travel times for juvenile fish than does flow augmentation and spill." The fisheries agencies disagree with this statement.

B.l.b. Alternatives and Impacts

There are no real alternatives associated with this option. Research and experimentation are still in progress to evaluate the effectiveness of artificially moving juveniles past the dams.

B.2. Provisions for Spill at Dams

To reduce turbine-related mortalities, spill and turbine manipulations can be used to bypass at least a portion of the juvenile migrant salmon. Such mortalities include those directly inflicted by passage through the turbines and those caused by predation on stunned fish. There is an abundance of evidence that direct turbine mortalities at main stem Columbia and Snake River dams under normal operating conditions are from 10 to 15 percent per dam although there appears to be considerable variability from dam to dam. At Ice Harbor Dam, when turbine-related predation is included, the total turbine-related mortality is 30 percent. However, Douglas County PUD figures for Wells Dam during a 1978 study indicate a mortality rate of 2.73 percent plus or minus 7.83 percent for steelhead and 0.81 percent plus or minus 17 percent for summer chinook. (The variability is due to different sampling techniques.) Relatively little is known about such turbine mortality. Hopefully, additional studies will provide a better information base upon which to make decisions. The U.S. Fish and Wildlife Service reports that "the Columbia River Technical Committee, made up of research scientists from all fishery agencies with jurisdiction on the river, strongly disagrees with the study methods and data interpretation used by Douglas County PUD."

Mortalities of juvenile migrant salmon passing over spillways of the main stem Columbia River dams are relatively minor (about 2 percent per dam). Therefore, passing fish over spillways rather than through the turbines appears to be a desirable procedure at most sites from a fishery standpoint. The Columbia River Fisheries Council has recommended spilling 20 percent of the total discharge during periods of peak migration (from mid-April through mid-June) although spill requirements may be decreased at projects where sequential generator dropping occurs. Even in moderate flow years, only modest harvestable runs have been produced from juvenile migrations associated with spills averaging more than 20 percent of the total discharge during the migration period. As can be seen in Figure 5, estimated turbine-related mortalities for the current system at the recommended minimum flow levels are 77 percent. Until other measures are taken to greatly reduce turbine-related mortalities, spill and turbine manipulation are needed to give some partial relief.

The department is recommending the provision of a volume of water which can be used for spill or flow subject to negotiation between the fishery agencies and the power generators. The department's proposal does not require that 20 percent of the total discharge be spilled.

It has been demonstrated that most juvenile migrants approach a dam in the daylight hours. Although some of these pass through the turbines during daylight, most pass through the turbines after dark, when visual reference is lost. If, at dusk, turbines are shut down sequentially starting with the shore units, juveniles that have accumulated can be "corralled" and led to the spillway,

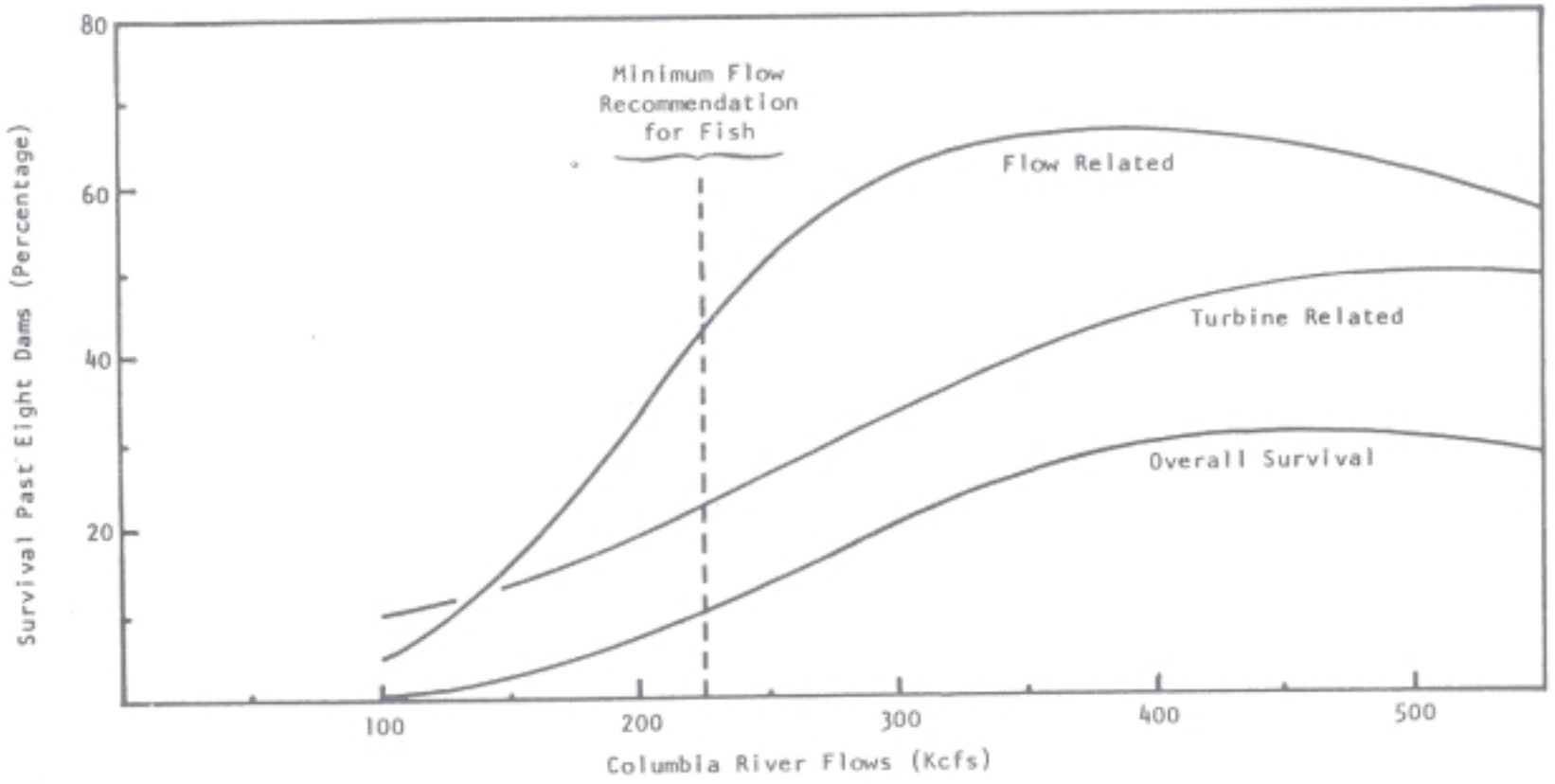


Figure 5. Estimated Survival of Juvenile Migrants Past Eight Dams or Reservoirs from Turbine Related Mortalities, Flow Related Mortalities, and Combined Losses (Overall Survival)

Source: Columbia River Fisheries Councils December 1978.

Studies conducted by National Marine Fisheries Service have demonstrated that at John Day Dam, mortalities of about 27 percent occurred with a modest spill (5 percent of the total daily discharge) and no turbine manipulation. However, when turbine manipulation was used with the spill the mortality rate dropped to 12 percent. Therefore, it appears that if turbine manipulation is used in conjunction with spill, more fish can be bypassed with less spill. The Corps of Engineers is also studying fish passage procedures and is evaluating the effectiveness of such activities. The Bonneville Power Administration reports that Corps of Engineers' sonar monitoring at John Day Dam during the 1979 juvenile migration showed that fish are able to detect spill and move towards it even if turbines are not manipulated.

B.2.a. Existing Situation

There is no requirement in the current licenses or authorizations for water to be spilled to pass fish on the main stem Columbia or Snake River dams. The water spilled during the past few years has been due to hydraulic capacity limitations, study requirements, or negotiation between the states, fisheries interests, and the dam operators.

B.2.b. Alternatives and Impacts

The alternatives for this option include various spill levels, with and without turbine manipulations, collecting and transporting fish around dams, screening and bypassing fish, and "no-action." The effectiveness and impacts associated with collecting and transporting fish as well as screening and bypassing them are discussed in previous sections.

The "no-action" alternative means the existing conditions would continue. For the past several years, the fisheries agencies have been negotiating with the dam operators for spill during downstream migration of the juvenile salmonids. The impacts on all instream resources depend on the amount of water spilled and the timing. Generally, the spill will benefit the fish and cause loss of power production. The impact on other uses of the river is minimal with the volumes that have been negotiated in the last several years. If no spill is negotiated and no other fish passage provisions made, the juvenile migrants will sustain approximately a 15 percent mortality loss at most of the dams. This results in a total turbine-related mortality of 77 percent past nine dams. Under this situation, there would be no impact on power production due to passage of downstream migrants.

The Columbia River Fisheries Council's recommendations for spill are 20 percent of the average daily discharge at each project, except where there is adequate turbine screening and bypassing and/or other proven safe passage, during the period of spring juvenile migration. Because the migration does not take place at exactly the same time each year, the recommended spill provisions span a block of time from April 15 through June 15 to give adequate coverage to the migration period. The recommendations include provisions to decrease the spill requirements when accompanied by requested sequential generator dropping (turbine manipulations).

The fisheries agencies indicate that if they could control the time the water is spilled based on the number of fish available in the forebay for passage, the total amount of water spilled could be reduced significantly while still providing safe fish passage.

The impacts associated with various spill levels depend on the amount of water spilled, the duration of the spill period and the energy requirements during the spill period. The primary benefit of spilling water is passage of juvenile salmon over the dams during downstream migration. A secondary benefit is the aesthetic value of water passing over the spillways to the viewing public. The primary impact is loss of power due to the water passing over the spillways rather than through the turbines. In high water years, there may be sufficient water to provide power production and spill with the current capabilities of the generating system. However, this is becoming less likely as the hydraulic capacity of the system is increased by the installation of additional generating units.

B.2.c. Valuation of Impacts

Table 18 in the Program Document displays the estimated economic impacts associated with the spill options considered. A brief summary of the process by which these estimates were derived is provided below. (A more detailed background paper on the economic impact analysis procedures used for this EIS is available upon request from the Department of Ecology.)

Fishery impact estimates proceeded from an assessment of the biological impacts upon fish populations of increased spill. This was done by assigning the smolt production goals reported by the Washington Department of Fisheries (Table 2 in the Program Document) to Spill Option F. Smolt production levels for Options A through E were assigned via linear interpolation back to present conditions. (In order to maintain consistency across all Spill Options, the instream flows recommended by the Columbia River Fisheries Council were assumed for all cases.) Relationships between smolt production and returning runs of adults were estimated via the data in Table 2 (Program Document) and the "flow-survival curve" provided by the C.R.F.C. (Figure 5). Finally, the impacts of increased runs upon commercial and sport catches were estimated via the data and information reported in the Pacific Northwest Regional Commission's Columbia Basin Salmon and Steelhead Analysis.

Assignment of dollar magnitudes to these enhanced fisheries utilized frameworks developed at Oregon State University (commercial) and the Washington State Department of Fisheries (sport). The amounts shown in Table 18 of the Program Document are to be interpreted as increments over and above the Baseline Case (Spill Option A).

Valuation of the power impacts associated with the Spill Options is based upon information provided by the U. S. Army Corps of Engineers, who assessed each spill level against historical Columbia River system runoff over the 40-year period from 1928 to 1968. This analysis led to identification of the average amount of hydroelectric generation foregone as a result of spill under 1985-86 loads and resources conditions. Although this generation would serve a variety of firm and secondary markets, it's dollar value was estimated upon the basis of replacement via thermal generation at a bus bar cost of 20 mills per kilowatt hour. (Note that this impact assessment is based upon full replacement of the lost average yearly hydroelectric generation. Neither of the two extremes on the range of possible outcomes -- load reduction via concerted conservation efforts or outright loss of the power -- was considered for this EIS.)

Reviewers of the First Draft EIS have suggested that comparisons between fishery impacts measured at market values and power impacts expressed in terms of generation costs are inappropriate. However, since all impacts reported here are in terms of increments as compared with the status quo (or some other suitable baseline), this may not be so. Specifically, the "market value" of a kilowatt hour of electricity should be (essentially) made up of the sum of generation costs, transmission costs, distribution costs, and the mark-up of the selling utility. If we bear in mind that we are here assessing the additional costs incurred by power users on account of the replacement of hydroelectric generation with thermal generation, and if -- further -- we view the latter three cost elements as constant irrespective of the generation source, then the incremental costs incurred should be roughly equal to the net difference between the two generation costs. Using the full cost of thermal generation (as in this case) provides a conservative estimate of the magnitude of this impact. Further, this is conceptually comparable to the estimated incremental benefits obtained from enhanced fisheries.

Inspection of Table 18 of the Program Document indicates that the adverse impacts of required spill upon power slightly-to-substantially exceed the beneficial impacts upon fisheries, as both sets of effects have been measured for this analysis. Alternative approaches to redressing the balance between these might include:

1. Vigorous practice of "intensive management" of spill for fish passage (as discussed above) including utilization of spill only when and to the extent needed for fishery purposes; thus, minimizing adverse power generation impacts.

2. Careful coordination of spill and flow requests, so that some part of the latter requirement can be satisfied by water which is passed over dams.

3. Foregoing spill.

Finally, it should be recognized that the analysis contained in this EIS has treated spill and flow as if they are wholly separable parts of the management of the Columbia River System. To the extent that this assumption is not warranted (as it may not be, in the case of fisheries), the fishery and power impacts of both need to be considered together. The analysis of the impacts of instream flow requirements can be found in section IV.B.6.c of the EIS.

The means of implementing the requirement for spill are outlined in the following section on reallocation of storage.

B.3. Reallocation of Storage

Reallocation of storage would involve changing some existing storage capacity from the dedicated purposes of flood control, irrigation, power production, and/or navigation to the purpose of instream resource protection. The stored water dedicated to instream resource protection could then be used to maintain instream flows and/or to provide spill at main stem dams during the juvenile salmon and steelhead migration.

B.3.a. Existing Conditions*

The existing projects on the main stem Columbia and Snake rivers in Washington are operated by the Bureau of Reclamation and Corps of Engineers (federal projects) and public utility districts from Chelan, Douglas, and Grant counties (nonfederal projects). The existing situation with regard to allocation of storage for instream resource protection is described below:

Federal Projects - In the past when fisheries agencies have requested releases of water from federal projects in aid in downstream passage of juvenile salmon and steelhead, water managers have asserted that they lack sufficient authority to conduct project operations in a manner that would conflict with other uses, such as generation of marketable power. For example, the Corps of Engineers in 1976 stated:

> "Storage projects within the Columbia River Basin are presently authorized and operated primarily for flood control, irrigation, and power. To draft this storage for the maintenance of a minimum instream flow would require the reauthorization of affected storage projects which could alter the current operation and management of the Columbia River System." 1/

More recently, a federal interagency task force reported the following assessments of the agencies' determination of their authority to protect and maintain instream flows at existing projects:

> Bureau of Reclamation - "The Bureau has determined that it has authority to maintain instream flows only if minimum flows were authorized as part of the project. Reservoir releases must satisfy any downstream water rights senior to the project water rights. Releases for rights junior to the project are not required, except where natural flows are in excess to the project rights."
>
> Corps of Engineers - "The Corps has determined that authority exists to protect and maintain instream flows only if minimum flows were an original project purpose. The Corps has certain limited administrative flexibility with respect to adjusting some authorized project purposes, but not for changing, deleting, or adding a purpose." 2/

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*This section relies heavily on information from the Anadromous Fish Law Memo (Issues 1 and 3) prepared by Prof. Michael Blumm, et al., of the Natural Resources Law Institute at the Lewis and Clark Law School.

1/ U.S. Army Corps of Engineers, Walla Walla District, Irrigation Depletions/Instream Flow Study (CRT 29), December 1976, p. IV-35.

2/ Water Policy Implementation Interagency Task Force - Instream Flow, "Federal Legislation for the Protection and Maintenance of Instream Flows." Prepared pursuant to the Directive dated July 12, 1978 from the President of the United States, May 1979, p. 3.

Notwithstanding these claims of a lack of legal authority to maintain instream flows, the Corps and the Bureau have recently demonstrated considerable flexibility in accommodating the needs of anadromous fish, especially during the severe drought which occurred in 1977. In this case, approximately 1.4 million acre-feet of water was used to enhance juvenile anadromous fish migration through the Columbia ("Fish Flow '77"). The water was supplied by three federal storage reservoirs: Libby and Hungry Horse in Montana and Dworshak in Idaho. Thus, there is considerable uncertainty as to the extent of the flexibility that federal water managers have to reallocate storage for protection of instream resources when published statements assert that the agencies lack such authority except when maintenance of instream flows is an authorized project purpose.

Nonfederal/PUD Projects - The five mid-Columbia PUD dams do not impound a significant amount of storage. These projects are essentially run-of-river dams with limited amounts of pondage. Despite this absence of storage, successful reallocation of upstream storage to provide instream flows and spill to aid fish migration must include the cooperation of the PUD project operators.

In early 1977, when requested to cooperate in the "Fish Flow '77" program to provide spill and flow to avert severe damage to the anadromous fish resources, the three mid-Columbia PUD's refused to participate in the program unless ordered to do so by the Federal Power Commission (now FERC). This refusal was based on contractual commitments, loss of power revenues, and the critical energy conditions at the time. The FPC did issue an order requiring the PUD's to cooperate in the program, and the PUD's cooperated fully.

The means available to the State of Washington to obtain storage reallocations and modifications of project operations to accommodate the resulting flows depend upon the operating agency of the project involved. Four means have been identified; they are described in more detail in the following paragraphs. Table 11 summarizes the applicability of these means to the various project operators.

TABLE 11
Washington State's Options for Modification of Project Operations

Means	Applicability		
	BR Project	COE Project	PUD Project
Negotiation/political intervention	X	X	X
Attachment of provisions to State-issued water rights	X		
Intervention in Federal Energy Regulatory Commission's relicensing process			X
Project reauthorization	X	X	

Negotiation/Political Intervention. This process is used on a continuing basis to accommodate the multiple uses of the Columbia River system. A recent notable result of this process was the accommodation made by Columbia River project operators in response to the request of the governors of Washington, Oregon, Idaho, and Montana to provide spill for fish during the 1977 drought. This event stands out from the remainder of the continuous negotiations between project operators and fisheries interests primarily due to its recent occurrence and the political/legal factors arising during the low water year which necessitated Federal Power Commission orders to the mid-Columbia PUDs to implement the negotiated program.

The principal forum for negotiations between Columbia River project operators and fisheries interests is the Committee on Fishery Operations (COFO) which was established in March 1975 under the aegis of the Columbia River Water Management Group (CRWMG). COFO includes representatives of Bonneville Power Administration, Corps of Engineers, Bureau of Reclamation, public and private utilities, and federal and state fisheries agencies. This group has met six to nine times per year since its establishment. In addition, a fishery agencies representative participates in the weekly river regulation briefing at the Corps' Reservoir Control Center in Portland. The purpose is to discuss river operations.

In addition to the above, the Washington Departments of Fisheries and Game are negotiating with the Mid-Columbia PUDs for full compensation of lost resources.

This general means of obtaining modifications in project operations offers maximum flexibility and minimum security. Decisions are made in the light of current runoff forecasts and fisheries and power needs. However, this process only provides short-term solutions with no firm legal base.

Water Right Provisions for Bureau of Reclamation Projects. The United States Supreme Court's July 3, 1978 decision in California v. U.S. (No. 77-285) strengthened the power of states to control water resources in federal reclamation projects. In this suit involving the New Melones Dam project, an element of the Central Valley Project, the court held that the Reclamation Act of 1902 allows California to impose conditions in water appropriation permits issued to the federal government under state law.

Under this ruling, the State of Washington would appear to have the authority to specify the manner of use of waters of the Columbia River above Grand Coulee Dam which have been withdrawn by the Department of Ecology under the provisions of chapter 90.40 RCW in response to the U.S. Bureau of Reclamation's application, but for which appropriation permits or certificates have not been issued. Such waters are identified in Table 12. Although there are limited opportunities for exercise of this authority, it has advantages in terms of costs and time requirements.

Closely related to the above is the potential for negotiating the purpose of use of the waters stored by Grand Coulee Dam under the Bureau of Reclamation's storage certificate covering 6,400,000 acre-feet for irrigation and power (1938 priority date). Such negotiations would have to be initiated by a request from the Bureau to change the provision of its certificate. If the Bureau were willing and sufficient legal authority on the part of the Bureau were determined to exist, the storage right could be amended as to purpose of use to provide storage for instream resources protection.

TABLE 12
May 23, 1980
Grand Coulee Project Water Rights and Withdrawals

Use Type	Action	Priority	Feature	Quantity (cfs)	Use Total (cfs)	Status
Irrigation						
	Permit #15994	5/16/38	Irrigation of completed portion of project 600,000 acres, 3,200,000 acre-feet	13,450		Extension granted to January 1, 1982
	Withdrawal	5/16/38	Irrigation of undeveloped portion of project, 429,000 acres	11,550		Withdrawal extended to Dec. 14, 1989. No water right filing to date. Request for extension is pending publication notice
			Irrigation total, water rights and withdrawal	25,000	25,000	
Hydroelectric Power						
	Certificate #11543	5/16/38	L & R powerplants, 18 units, partial supply	75,000		Recorded water right certificate
	Permit S3-21872P	10/16/69	L & R power plants, supplemental supply Two pump turbines	18,000 3,700		Completion of construction due October 1, 1981
	Withdrawal	10/14/69	Third power plant, six units Four pump turbines	184,000 7,400		Water right filing for 184,000 cfs. Withdrawal for remaining 7,400 cfs expires September 11, 1983
	Water Right Appl. #S3-26258	5/7/75	Third power plant, supplemental supply	22,000		Water right application filed
			Hydroelectric power, total		310,100	
Storage						
	Certificate #R3-21869C	5/16/38	Active reservoir storage for irrigation and hydropower, 6,400,000 acre-feet			Recorded water right certificate
	Certificate #R3-22472C	8/12/70	Dead reservoir storage for hydropower and irrigation, 3,162,000 acre-feet			Recorded water right certificate

Federal Energy Regulatory Commission (FERC) Licenses. The Federal Energy Regulatory Commission (formerly the Federal Power Commission) licenses the construction, operation, and maintenance of nonfederal hydroelectric projects under the authority of the Federal Power Act of 1920. The term of such licenses is generally 50 years. Licenses are renewed for terms of 10 to 50 years under a process similar to that followed for the initial issuance of a license.

The Columbia River power projects under Federal Energy Regulatory Commission licenses are identified in Table 13.

Rock Island Dam is the oldest major hydroelectric project on the Columbia River. The Commission licensed the dam in 1930, and like the other mid-Columbia projects, it must be relicensed after 50 years. Relicensing proceedings for this project will thus begin in 1980. The other four mid-Columbia dams are of more recent vintage. The Priest Rapids project, which consists of two dams – Wanapum and Priest Rapids – was licensed in 1955. The Rocky Reach dam was licensed in 1956, and the northernmost of the dams, Wells, was licensed in 1962.

These four dams were built to follow (in general) the comprehensive plan set forth in the 1948 Corps of Engineer's Review Report on the Columbia River and Tributaries. That plan contemplated that the projects would serve power and flood control purposes primarily, but the importance of other purposes was not disregarded. The study identified the improvement of navigation, the further expansion of irrigation and recreation, and the development of upstream storage to allow the mid-Columbia projects to provide adequate flows for fish as important considerations.

Although the licenses for the Rock Island, Rocky Reach, and Wells projects contain no specific requirement for minimum flows for instream resources protection, fisheries protection was an explicit consideration in the construction of the mid-Columbia dams. Most obviously, the Commission required the installation of fish ladders at each project to permit the upstream migration of anadromous fish. (Section 18 of the Federal Power Act requires the FERC to order the licensee to construct "such fishways as may be prescribed by the Secretary of the Interior.")

Perhaps even more important are several open-ended conditions in the licenses for the mid-Columbia projects that give the FERC authority to require modifications in the operation of the projects in order to protect the anadromous fish . . . . For example, Article 39 of the Priest Rapids and Wanapum license, which is similar to provisions in the other licenses, specifically requires the licensees to modify project operations in the interest of fish life.

> The licensee shall construct, operate, and maintain or shall arrange for the construction, operation and maintenance of such fish ladders, fish traps, fish hatcheries, or other fish facilities or fish protective devices for the purpose of conserving the fishery resources, and comply with such reasonable modifications in project structures and operations in the interest of fish life in connection with the project as may be prescribed hereafter by the Commission upon recommendations of the Secretary of the Interior, the Washington State Departments of Fisheries and Game and the licensee.

Furthermore, each mid-Columbia license contains a standard provision allowing the FERC to regulate the volume and rate of water releases from the projects "in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes." Coupled with the Supreme Court's 1967 ruling in Udall v. FPC (387 U.S. 428) that the emphasized language requires consideration of anadromous fish needs, these license provisions provide the FERC with a powerful mandate to ensure that the operations of its licensees are consistent with anadromous fish protection and enhancement.

The U.S. Supreme Court's 1978 U.S. v. California decision regarding New Melones Dam, which held that states may impose conditions on water appropriation permits issued for federal reclamation projects, may have applicability to projects licensed by FERC as well. This conclusion follows from the similarity in language between the Federal Power Act and the Reclamation Act that the Supreme Court interpreted. Thus, state laws that, for example, require the maintenance of minimum flows may be enforceable against federally licensed dams.

TABLE 13
Columbia River Projects In Washington State Licensed
By The Federal Energy Regulatory Commission

Project No.	Project Name	Licensee	License Expiration Date
943	Rock Island	PUD No. 1 of Chelan Co. and Puget Sound Power & Light Co.	1-20-80
2114	Priest Rapids (and Wanapum)	PUD No. 2 of Grant Co.	10-30-05
2145	Rocky Reach	PUD No. 1 of Chelan Co.	6-30-06
2149	Wells	PUD No. 1 of Douglas Co.	5-31-12

Source: Federal Power Commission, 1975 Annual Report, January 19, 1976. p. 84.

Reauthorization of Federal Projects. Given the uncertainty surrounding the extent to which federal water managers have authority to reallocate storage for protection of instream resources, there is a need for clarification of such agency authority and responsibility. Such clarification could take the form of federal legislation modifying the original project authorizations. Although obtaining agreement on reauthorization legislation could prove to be a time-consuming process, it would provide a long-term solution with a firm legal base.

A recent study conducted at the Natural Resources Law Institute, Lewis and Clark Law School, attempted to resolve some of the ambiguities concerning the existing authorities which control operation of federal dams in the Columbia Basin. These researchers reviewed the authorizing legislation and legislative history for each major federal dam in the basin (see Table 14 for a summary of these authorizations); analyzed judicial and agency interpretations of the language in federal water project statutes; and examined the effect that statutes of general application, such as the National Environmental Policy Act and the Fish and Wildlife Coordination Act, may have on the authority of the controlling federal agencies. Their report reaches the following conclusions:

> ". . . the dams need not be operated for maximum power production at the expense of other functions of the projects. In fact, power generation is specifically mentioned as a project purpose for only four of the dams. If power generation can be read into the remaining statutes as an authorized function of the dams, it should be equally valid to read fish protection and enhancement into the statutes as one of the functions of the projects, especially in light of Congress's consistent manifestation of concern about the effects of water projects on the environment ,in general and on migratory fish in particular.
>
> "From the reports in connection with which Congress authorized the major Columbia Basin project, it is apparent that the Corps of Engineers has long been both aware of and concerned about the effects the dams would have on anadromous fish. The reports evince a willingness on the part of the Corps to ensure that fish be able to pass the dams with a minimum degree of mortality. It is not unreasonable to infer that Congress expected the Corps to retain such concerns throughout the life of the projects.
>
> "Judicial interpretation of water project statutes similar to those applicable to the Columbia Basin projects permits accommodation of a wide variety of uses for the projects. Moreover, through the enactment of a series of statutes of general applicability, Congress has directed that the adverse effects of water projects on anadromous fish be minimized, and has required federal construction agencies to give fish and wildlife equal consideration with other project purposes in the planning and operation of such projects.

TABLE 14
Federal Columbia River Project Authorizations Summary

Name of Project	Authorization Act	Express Purposes	Legislative History
Bonneville	Rivers & Harbors Act of 1935	Utilization of surplus power	U.S. Senate requested the commissioner of fisheries to study and recommend steps that may be necessary to attain the "full conservation" of salmon and other commercial fish of the Columbia River.
*Grand Coulee	Rivers & Harbors Act of 1935	Flood control, navigation, regulation of stream flow, power, irrigation, and "other beneficial uses."	No history for Grand Coulee.
*Hungry Horse	Act of 6/5/44	Flood control, navigation, regulation of river flow, power, and "other beneficial uses."	Storage would provide for the repeated used of water for multiple purposes, without restriction to the most efficient use of the water from an engineering standpoint.
Ice Harbor Little Goose Lower Granite Lower Monumental McNary	Rivers & Harbors Act of 1945	Navigation, irrigation Navigation, irrigation Navigation, irrigation Navigation, irrigation Navigation, power, irrigation and fish protection ("by affording access to . . . spawning grounds or by other appropriate means.")	High dam at The Dalles rejected in favor of five lower dams that would pro vide benefits of a high dam without substantial harm to fish. Division engineer recommended that adequate protection, vision be made at all dams for the passage of fish.
Chief Joseph	Rivers & Harbors Act of 1946	None	No adverse effects on fish anticipated because Grand Coulee already blocked fish passage into upper Columbia River.
*Albeni Falls *Libby John Day The Dalles	Flood Control Act of 1950	Navigation, flood control, & "other purposes." Albeni Falls: "Multiple purposes."	Libby project would provide conservation benefits incidentally. Legislative history of the Act indicates the Corps was concerned about improving low river flows for the benefit of fish. Report concluded that the conclusions and recommendations of federal fisheries agencies would be carefully considered so that the best solution would be found to preserve fish at each site under discussion.
*Dworshak	Flood Control Act of 1962	Flood control and "other purposes."	Improvement of summer low flow conditions would compensate for loss of spawning grounds inundated by the reservoir.

*Storage dam capable of improving low river flows for the benefit of anadromous fish.

Source: Blumm, et al., Anadromous Fish Law Memo, Issue 1, June 1979.

"Fisheries scientists predict that upriver races of salmon and steelhead in the Columbia Basin will be irreparably harmed, or even destroyed, if the present method of operating the Basin's hydroelectric projects is not modified to adequately accommodate the needs of anadromous fish. Federal agencies that control the operation of Columbia Basin water projects are armed with an impressive arsenal of federal statutes and cases from which they may derive the authority to provide the protection and enhancement of salmon and steelhead runs. It is indeed unfortunate, then, that during periods of critically low river flow, fisheries agencies have had to resort to direct appeals to the Governors and Congressional delegations of the Northwest in order to ensure that water manages provide for the instream flow needs of anadromous fish.

"Proposed congressional action requiring Columbia Basin projects to be operated in a manner consistent with anadromous fish protection (see section 8 of H.R. 4159) could serve to end any uncertainties with respect to the authorities possessed by federal water managers. This study illustrates that such legislation would be consistent with longstanding Congressional, administrative, and judicial pronouncements, regarding the importance of maintaining the vitality of migratory fishery resources when conducting water project operations.

"Yet, even without Congressional action, existing laws appear to warrant alterations in the manner in which Columbia Basin water projects are operated. The federal agencies that control the operation of the projects have interpreted their existing authorities too narrowly; they quite probably already hold the key to dramatically restore the viability of Columbia Basin stocks of salmon and steelhead that now face extinction." [from Blumm, et al., Anadromous Fish Law Memo, Issue 1, June 1979, pp. 5-6.]

B.3.b. Alternatives and Impacts

The alternatives associated with reallocation of existing storage are "no-action" and various quantity levels. The only existing reservoir in Washington that has enough storage at the right location to significantly aid instream resource protection is the Grand Coulee pool (Lake Roosevelt). Therefore, the alternative analysis was concerned with the reallocation of storage upstream of Wells Pool.

The "no-action" alternative would mean continued operation of the system for the currently authorized purposes (see Table 14). There would be no assurance that storage would be allocated to protect instream resources and no new impacts on the other uses of the water.

A portion of water stored behind Grand Coulee under state water right certificate to the Bureau of Reclamation for irrigation and power purposes could be reallocated to include instream resource protection if so requested by the Bureau of Reclamation (if they have sufficient legal authority). The impacts associated with such a reallocation would depend on the amount of water allocated to instream resource protection.

The effects of reallocation of the stored water to protect instream resources would be 1) to limit the amount of water available for future irrigation appropriation rights; 2) to decrease the amount of power that is generated if the water is used to provide spill for fish passage (see section IV.B.2); 3) to place constraints on the use of the Columbia River for providing peaking capacity if the water is used to provide instantaneous flows (see section IV.B.6); and 4) to benefit fish and wildlife, recreation, and the natural and cultural environment by providing flows during critical periods (see section IV.B.6).

B.4. Water Quality Management

Water quality is important to many uses of the Columbia River, such as fish and wildlife habitat, irrigation, recreation, aesthetic enjoyment, as well as municipal and industrial water supply. The existing quality of the Columbia and Snake Rivers is generally excellent (Class A with special conditions for temperature) 1/ and well suited to these uses.

Of all the uses of the Columbia River system, fisheries is most dependent on good water quality. The critical parameters for maintaining salmon and steelhead are temperature, dissolved gas concentrations, heavy metal concentrations, and herbicide concentrations.

Perhaps no other single parameter has such a determining effect on a fishery as does water temperature. It makes the difference between a steelhead and salmon stream or some less desirable fishery such as catfish or carp. Water temperature is especially critical during the spawning runs (June through October) and during downstream migration of smolts (March through August).

B.4.a. Existing Conditions

The Columbia River water quality is monitored by the Washington State Department of Ecology from the Canadian border to the Oregon border. The parameters that are monitored include: flow, temperature, dissolved oxygen, fecal coliform organisms, conductivity, pH, turbidity, nitrogen, phosphate, and percent saturation. Table 17 shows the maximum, minimum, and median values for these parameters at each sampling station.

B.4.b. Alternatives and Impacts

The fishery agencies indicated that temperature has a major impact on metabolic rates of fish. Since anadromous salmonids feed very little on their spawning run, the result of increased temperature is an increased

1/ Chapter 173-201 WAC, Water Quality Standards for Waters of the State of Washington. See Table 15 for a summary of the general criteria and Table 16 for the specific standards applying to the Columbia River.

TABLE 15 – Summary of Water Quality Criteria

Class Designation	Typical Uses	Fecal Coliform [1] (organisms/100 ml)	Dissolved [2] Oxygen (mg/l)	Temperature [3] (°C)	pH [4]	Turbidity [5] (NTU)	Other
CLASS AA (Extraordinary)							
Exceeds requirements for substantially all uses	Potable Water supply; fishing; swimming; fish and shellfish reproduction and rearing						
Fresh Water		50/100	9.5	16	6.5-8.5	5/10%	(7)
Marine Water		14/43	7.0	13	7.0-8.5 (Var. 0.2)	5/10%	(7)
CLASS A (Excellent)							
Meets or exceeds requirements for substantially all uses	Potable Water supply; fishing; swimming; fish and shellfish reproduction and rearing						
Fresh Water		100/200	8.0	18	6.5-8.5	5/10%	(7)
Marine Water		14/43	6.0	16	7.0-8.5 (Var. 0.5)	5/10%	(7)
CLASS B (Good)							
Meets or exceeds requirements for most uses	Industrial and agricultural water supply; fishing; shellfish reproduction and rearing						
Fresh Water		200/400	6.5	21	6.5-8.5	10/20%	(7)
Marine Water		100/200	5.0 (Min. 70% saturation)	19	7.0-8.5 (Var. 0.5)	10/20%	(7)
CLASS C (Fair)							
Meets or exceeds requirements of selected and essential uses	Cooling water; fish passage; commerce and navigation						
Fresh Water		N/A	N/A	24	6.5-9.0	10/20%	(7)
Marine Water		200/400	4.0 (Min. 50% satuation)	22	6.5-9.0 (Var. 0.5)	10/20%	(7)
LAKE CLASS							
Meets or exceeds requirements for all uses	Potable Water supply; fishing; swimming; fish and shellfish reproduction and rearing	50/100	(6)	(6)	(6)	5	(7)

(1) Median values shall not exceed first value above; no more than 10% of samples shall exceed second value shown.

(2) Shall exceed values shown, except that natural dissolved oxygen values for marine water can be degraded by up to 0.2 mg/l by man-caused activities when natural upwelling occurs.

(3) Shall not exceed values show. Note: additional criteria for temperature are found in the regulation.

(4) Shall be within range shown; man-caused variation shall be less than amount shown.

(5) Shall not exceed values shown over background when background turbidity is 50 NTU or less, or have more than indicated percent increase when background is more then 50 NTU.

(6) No measurable change from natural conditions.

(7) For all classes, the total dissolved gas concentration shall not exceed 110 percent of saturation. Qualitative statements for toxic, radioactive, or deleterious material concentrations; and for aesthetic values are included in the criteria for each class designation.

Source: WAC 173-201, revised 12/19/77.

TABLE 16
Water Quality Standards for the Columbia River

Columbia River from mouth to the Washington - Oregon border (river mile 309).	Class A
Special conditions - Water temperatures shall not exceed 20.0° Celsius due to human activities. When natural conditions exceed 20.0° Celsius (freshwater), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° Celsius; nor shall such temperature increase, at any time, exceed 0.3° Celsius due to any single source or 1.1° Celsius due to all such activities combined. Dissolved oxygen shall exceed 90 percent of saturation.	
Columbia River from Washington - Oregon border (river mile 309) to Grand Coulee Dam (river mile 595).	Class A
Special conditions from Washington - Oregon border (river mile 309) to Priest Rapids Dam (river mile 397). Temperature - Water temperature shall not exceed 20.0° Celsius due to human activities. When natural conditions exceed 20.0° Celsius (freshwater), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° Celsius; nor shall such temperature increases, at any time, exceed $t = 34/(T+9)$.	
Columbia River from Grand Coulee Dam (river mile 595) to Canadian border (river mile 742).	Class AA

The symbol "t" represents the permissive temperature change across the dilution zone; "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Source: Chapter 173-201 WAC, Water Quality Standards for Waters of the State of Washington.

TABLE 17
Water Quality Data – Columbia River

Sampling Station	River Mile	Flow cfs	Temp Deg -C	Dissolved Oxygen mg/l	Fecal Coliform /100 ml	Conductivity Micromhos	pH	Turbidity NTU	Kjeldahl Nitrogen mg/l	Total Phosphate mg/l	Percent Satuation
PORT OF PASCO	328.3										
Maximum		415,100	20.00	15.00	20	186	8.30	32			
Minimum		78,000	0.70	8.50	20	125	7.70	1			
Median		166,500	11.90	12.45	20	165	7.90	4			117.3
NEAR VERNITA	388.1										
Maximum		410,000	20.80	15.90	66	370	8.50	29	0.93	0.09	
Minimum		80,000	1.80	9.70	1	109	6.50	1	0.02	0.01	
Median		146,000	11.50	12.50	2	148	7.90	4	0.22	0.03	116.4
BELOW ROCK ISLAND DAM	450.9										
Maximum		412,000	20.10	16.00	540	220	9.00	26	0.78	0.74	
Minimum		65,800	2.10	9.30	1	114	6.40	1	0.09	0.01	
Median		147,000	12.30	12.00	5	153	8.00	4	0.22	0.04	114.5
GRAND COULEE DAM	596.0										
Maximum		334,000	18.50	18.00	40	197	8.50	9	0.93	0.08	
Minimum		72,800	0.60	7.80	1	110	6.70	1	0.04	0.01	
Median		122,500	11.55	11.80	2	150	7.80	3	0.22	0.03	112.2
NORTHPORT	735.1										
Maximum		362,000	17.90	14.30	24	190	7.90	7	0.47	0.07	
Minimum		50,000	1.40	10.20	15	135	7.50	1	0.01	0.01	
Median		96,800	11.00	12.75	20	150	7.70	3	0.04	0.04	121.7

Source: Washington State Department of Ecology

weight loss during migration. Energy for swimming and other life functions is drawn from fat reserves. When these reserves become inadequate, the fish converts its flesh into chemical components that can be used to produce energy. In recent tests on adult sockeye salmon, the weight loss for 10°C (Celsius) (50°F) water was 7.5 percent and for 16.5°C (62°F) water, the average loss was 12 percent of their body weight (Bouck, Chapman, et al., 1976). Females with their developing eggs also lost more body weight than the males at both temperatures. This may be significant in the Columbia River fishery because the water temperature is often above 16.5°C during adult migration.

This metabolic drain on the fish can have several important but less obvious effects. The fisherman who catches the sockeye salmon living at 16.5°C not only gets less fish weight, he also gets a lower-quality fish. The latter is because the fat reserves are approaching depletion, the skin is dark, the flesh is pale, and the jaw is hooked. At this point, the fish's main value is to reproduce the species, die, and fertilize the stream with its decomposing nutrients.

Unfortunately, the metabolic wear and tear caused by higher temperatures also has an adverse effect on primary sexual development of sockeye salmon. Testes are 25 percent smaller and lighter eggs are produced at 16.5°C than at 10°C.

Another effect of temperature is that juvenile salmon and steelhead have difficulty making the parr-smolt* transformation when they live at or above 13°C (55°F) (Zaugg et al., 1972). When temperatures exceed 13°C, the fish grow well and appear to be normal, but they cannot easily adjust subsequently to living in salt water. This has great significance to salmon and steelhead in the Columbia and Snake rivers, because temperatures therein generally exceed 13°C as early as mid-May and the downstream migration of smolts spans March through August.

Still another effect of elevated water temperatures is increased susceptibility to infections by pathogenic organisms and disease which cause an increased death rate in fish. Lower dissolved oxygen levels, also caused by increased water temperature, can have a direct bearing on the health and welfare of fish. If the levels get too low, there is not enough oxygen and the fish may die.

Nitrogen supersaturation is another parameter of water quality that can have a significant effect on the survival rate of fish. (Refer to section IV.A.4, Spillway Deflectors, for a discussion of why nitrogen super-saturation occurs and its effects on fish.) The critical threshold for salmon and steelhead is 115 to 120 percent of saturation.

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* See Appendix E for a definition of terms and Appendix F for a discussion on fish biology.

Heavy metals and pesticides are also deleterous to fish survival. Small amounts of heavy metals in the water during rearing has a harmful effect on smoltification* and early marine survival (Lorz and McPherson, 1976). Both low level herbicide and metal concentrations can affect migratory behavior (Lorz et al., 1978).

The alternatives to maintaining good water quality are basically non-existent. The water quality of that part of the river that falls within Washington's jurisdiction is governed by the Water Pollution Control Act (Chapter 90.48 RCW) and the Water Quality Standards for waters of the State of Washington (Chapter 173-201 WAC). The water quality is maintained through a permit system. Every wastewater discharge into the Columbia River from the State of Washington is covered by a permit. The quality of the water discharged must meet the requirements set forth in that permit. The discharges are periodically monitored to see that they meet the permit requirements.

One alternative is to allow the water quality to be degraded. This would require a lack of enforcement of the existing regulations, a change in the regulations, or a variance from the regulations. There is a mechanism in the regulations for granting variances to the water quality standards.

> Note: The Department of Ecology in July 1979 approved and sent to the Environmental Protection Agency for approval a draft of a renewed NPDES waste discharge permit for the Washington Public Power Supply System's Hanford Generating Project. The draft permit includes a variance from the thermal criteria of the state water quality standards to allow the continued discharge of once-through cooling water to the Columbia River. The variance provision was developed in accordance with section 316(a) of the Federal Water Pollution Control Act. EPA has not approved the permit as of January 1980.
>
> The Hanford Generating Project (HGP), with a rated capacity of 860 megawatts, produces up to 5 million megawatt-hours of electric energy per year from steam produced by the New Production Reactor which is operated by the U.S. Department of Energy for plutonium production. The HGP discharges up to 1,256 cfs of water into the Columbia River approximately 17 miles downstream from Priest Rapids Dam at temperatures up to 43°F. above ambient river temperature. At this point were this effluent is fully mixed with the river (approximately 5 miles downstream), the resulting about 1.2°F. at the minimum regulated flow of 36,000 cfs and 0.3°F. at the average annual flow of 120,000 cfs.

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*See Appendix E for a definition of terms and Appendix F for a discussion on fish biology.

Based on information supplied by WPPSS and several state and federal agencies and in consideration of public comments received, the department determined that the continued discharge of once-through cooling water would not cause appreciable harm to important fish or wildlife populations. Moreover, requiring HGP to undertake off-stream cooling was deemed unjustifiable because of the uncertain remaining lifetime of the project -- the project's current contract for steam from the Department of Energy reactor expires in 1983 and in any case is not expected to be extended beyond 1989. All new thermal power plants in this area are required to have off-stream cooling systems. A condition of the draft permit would require WPPSS to submit a study on the effects of shifting the project's 10-week annual maintenance shutdown from May and June to the critical temperature months of August and September.

Another alternative would be improved water quality. This may indeed be what is happening due to stricter control over discharges and improved treatment systems for wastewater.

The impacts o f these alternatives would affect the fisheries resource first. Improved water quality, especially lower temperatures, would be of benefit while degraded water quality would be harmful to fish. The incremental impacts of small changes in water quality are currently the subject of much interest and study.

B.5. Conservation and Efficiency Fundamentals

In order to promote efficient water use and conservation during low water years, the department proposes to utilize all reasonable measures of influence on water users to insure that the state's water resources are conserved and that the burden of water shortages in low water years is shared by the various users to the greatest extent practicable. To accomplish this, the department will attach a provision to all future consumptive water right permits and certificates for use of water from the main stem of the Columbia River in Washington State. Water right permits and certificates issued prior to the adoption of this provision by regulation would not be affected, .but existing applications and those filed in the in the future would be affected. Water rights issued from the reserved waters in the John Day/McNary Regulation (Ch. 173-531a WAC) that are issued after the adoption of this program will be subject to the provisions of this program.

B.5.a. Existing Conditions

There are no existing base flow, minimum flow, or conservation requirements for main stem Columbia River irrigation diversions. As discussed elsewhere in this report, minimum instream flows and spill requirements have been recommended by the Columbia River Fisheries Council. However, these have not been adopted to date by state or federal water management agencies.

The concept of conservation requirements for future irrigation was developed initially for the John Day/McNary Pools Water Resources Program in 1977. The conservation provision proposal was deferred, however, so that it could be considered for the entire Columbia River main stem in Washington.

Under Washington's water rights system, the date of priority determines whose water rights will be regulated when the stream flow is insufficient to fulfill all water rights. Because first in time is first in right, the junior (more recent) appropriations must be completely turned off to provide water for senior appropriators during water-short times. In practice, Columbia River main stem water rights have not been regulated in the past. Unlike smaller tributary streams which may dry up completely in dry years, the Columbia River channel physically contains water at all times, even in drought. As a result, junior diverters do not affect the senior diverters' ability to pump water. Thus, regulation of the junior appropriators to allow sufficient water for senior rights has not been necessary.

Other user groups (notably fishery and hydropower interests), however, claim that diversions for irrigation and other consumptive uses negatively impact their use of water and should therefore be regulated or prohibited, particularly in low flow years. The legitimate claims of instream user groups are clouded because water rights, in the traditional and legal sense, have not been established or quantified for many instream requirements such as fisheries.

A number of major reservoirs with a total of 43.5 million acre-feet of storage have been built in the Columbia River Basin. This storage is manipulated by federal and Canadian entities for the express purposes of flood control, hydroelectric power generation, and federal irrigation project use. Operation of storage facilities determines in large measure the flow of the Columbia River.

As a result, main stem irrigation water rights have not been regulated by the state in the past to satisfy instream use needs. In order to place some responsibility on irrigators to help conserve water during dry years, the department has proposed the conservation and efficiency fundamentals.

B.5.b. Alternatives and Impacts

In the development of the recommended program, six alternative conservation cutback proposals were evaluated. These proposals would each have required a reduction in the quantity of water allowed to be diverted in a low water year. However, because state law does not provide authority to establish prorata reductions in future water rights for conservation purposes, the department has chosen to establish the conservation and efficiency fundamentals discussed above.

B.5.c. Conservation and Efficiency Fundamentals -- Economic Impacts

This provision is not expected to have significant economic impacts as compared with a reasonable projection of future status quo conditions. Although irrigators are not charged for water per se, they do have to pay for the energy required for water pumping and application, and other farm inputs. The likelihood that the cost of these will increase significantly in the future will encourage farmers to economize in their use of these factors of production and, hence, on the water which compliments them in the farm operation. This is especially likely to be the case where high lifts and/or sprinkler application are involved.

A secondary impact of the conservation requirement would be an improvement in water quality. This would result partly because irrigators will have an additional incentive to make the most efficient possible use of the water they are allowed to divert. Thus, capture and reuse of runoff (return flow) waters, which may contain significant concentrations of pollutants will be encouraged. Also, more water will be left instream to dilute pollutants that do get into the river.

B.6. Establishment of Instream Flows

There are two important aspects to instream flows – minimum instantaneous quantities and minimum average quantities.

Instantaneous flow is most important below Priest Rapids Dam to maintain a continuous water level in the free flowing reach of the Columbia River. Instantaneous flows in other parts of the river may be helpful in reducing delay of adult migrants at all main stem dams.

For instream resource protection, daily flow averages are more significant than averages for longer time spans. Average daily flow is important in the ponded portions of the rivers to provide flow velocity in the pools for movement of juvenile salmon through the system and to maintain good water quality which is important to municipal and industrial water supply, fish, wildlife, and recreation uses of the river.

B.6.a. Existing Conditions

Before the construction of dams on the main stem Columbia and Snake rivers, downstream migrant salmon and steelhead could withstand a very wide range of flows without catastrophic mortalities. However, minimum flows that would have adequately moved water and juveniles through free flowing rivers are not adequate to move those fish through chains of dams and reservoirs. The problem is two-fold: (1) water velocity is much slower through reservoirs because of the greatly increased cross sectional area, and (2) storage of water during the freshet period for later release for power production reduces river flow and water velocity during the time of downstream migration of juvenile salmon and steelhead. The combined effects of these conditions can be, and indeed have been, catastrophic to the fisheries resource.

Since 1974, an effort has been made to achieve minimum instream flows for fish on a voluntary basis through the Committee on Fisheries Operations (COFO). COFO was created to better coordinate regulation of the river and reduce the severe fish mortality problem. Its membership consists of representatives from the fisheries agencies and the power entities. This approach has helped on an interim year by year basis, but it lacks the authority to assure the level of instream flows that are necessary to maintain the fisheries resource.

Mitigative measures have consisted primarily of dam modifications to facilitate passage of adult or juvenile migrants. Compensation received, to date, has been primarily, for loss of natural spawning areas and has been in the form of hatcheries or artificial spawning channels. No measures have been provided to mitigate or compensate for the adverse impacts of reduced spring flows on anadromous fish runs caused by the construction of the dams.

There are no formal requirements to provide minimum flows at ten of the eleven dams on the mainstem of the Columbia River. The exception is Priest Rapids with a Federal Power Commission (now FERC) license requirement for a minimum 36,000 cfs instantaneous flow provided for requirements of the downstream Hanford nuclear plant. The Federal Energy Regulatory Commission has been petitioned to increase the minimum flow level by Washington State Department of Fisheries, National Marine Fisheries Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and the Yakima Indian Nation. The outcome of this petition is still pending.

Douglas County PUD commented that the existing 36,000 cfs flow requirement below Priest Rapids exceeds the natural flow of the river in some water years. The PUD stated that 36,000 cfs could be sufficient for spawning below Priest Rapids if care is taken during the spawning season to be sure that the water level does not permit the fish to spawn at a higher elevation than will be covered later in the year with a flow of 36,000 cfs. The Washington Department of Fisheries disagrees and stated that "if fall chinook were not permitted to spawn above the 36,000 cfs level, an estimated 127,000 square yards of high quality spawning gravel would be lost between the 36,000 and 50,000 cfs water levels. An additional 111,500 square yards of lesser quality gravel would also be lost between the 50,000 and 70,000 cfs water level."

Commentors have raised the issue of availability of cooling water for future nuclear power plants on the Hanford Reservation. It has been pointed out that Governor Ray has suggested that all future plants in the state be located at Hanford. The Tri-City Nuclear Industrial Council has commented that twenty or more such plants could be constructed.

Currently, there is one operating nuclear power plant on the Hanford Reservation. Commonly known as the "N" reactor, it supplies heat to power WPPSS steam turbine generators. "Once through" cooling is employed by this facility. Cooling towers have not been added as the plant is expected to be decommissioned in a few years. Over 1,500 cfs is used and returned to the river.

Three new reactors are being built at Hanford (WPPSS Nos. 1, 2, and 4). These will use forced-draft cooling towers. It is expected that any future facilities would also use cooling towers. A quantity of 40 cfs, directed with 30 cfs of that consumed is a good estimate of cooling tower requirements per 1,000 megawatts. The 10 cfs blowdown is returned to the river.

Assuming that an estimate of 20 additional nuclear plants is correct and that each is roughly 1,000 megawatts, an additional 40 x 20 = 800 cfs would be required. 10 x 20 = 200 cfs would be returned to the river. The net depletion would be less than 50 percent of the existing "N" reactor use. It is expected that all diversions and returns would be located in the free-flowing "Hanford Reach."

Commentors have raised the question of how this anticipated water demand should be handled in the proposed CRIRPP. The following options appear to be available:

1. Make the cooling water subject to the full effects of the program: This would require that future plants, subject to the minimum flows, curtail water withdrawals in times of shortage. This would lead to a loss of power production and would occur in a low water period when hydro projects might not be generating up to capacity.

   In practice, however, authorizations for water for thermal power projects are issued by the State Energy Site Evaluation Council. The issue of whether the Council would be required to impose the conditions in the proposed Department of Ecology regulation on its water authorizations has not been specifically addressed by the legislature and remains an unanswered legal question.

2. Exempt Cooling Water from Regulation: This would remove any question regarding the applicability of the regulation to future power plants by foreclosing the option of apply the minimum flow provision to future nuclear power plants. However, such a move might be viewed by some as a commitment to approve water rights or changes thereto for such facilities. Since such facilities are under the jurisdiction of EFSEC, DOE does not wish to imply prejudgment of applications for surface water or changes in existing rights they might receive.

3. Reserve Water for Future Nuclear Facilities: This would insure water for nuclear facilities should they be approved. The department does not consider such a reservation appropriate given the existing jurisdictional situation and the current use level for thermal production at this site.

The mid-Columbia PUDs are planning modifications at four of the five projects which they operate.

At Wells Dam, Douglas County PUD proposes to increase the level of Lake Pateros by two feet, measured at the dam. This will increase the effective head and result in an increase in generating capacity of 14.4 megawatts (MW). Because there will be some tailwater encroachment at Chief Joseph Dam, the net system gain will be only 5.2 MW.

At Rocky Reach Dam, Chelan PUD proposes to raise the pool three feet at the dam. There will be some tailwater encroachment at both Wells and the Chelan Falls projects. No firm estimates of net increase in capacity have yet been made.

Grant County PUD plans to make modifications at both its Priest Rapids and Wanapam dams. These two facilities currently have the lowest turbine capacity on the mid-Columbia. Additional turbines are planned at both facilities. In addition, changes in reservoir elevation and fluctuation are being studied. Although a final proposal has not yet evolved, it is expected that capacity will be increased by several hundred megawatts.

The Department of Ecology is working with all three PUDs in order to achieve procedural efficiencies at the local, state, and federal levels. The aim is to not only combine similar procedures but also to identify controversial issues and seek solutions where possible. It is hoped that adoption of an instream flow program, together with pursuit of the current downstream migrant and Venita Bar studies, will contribute significantly to the latter goal.

B.6.b. Alternatives and Impacts

1. Salmon and Steelhead Trout

Flow-related factors governing the maintenance of productive runs of salmon and steelhead are extremely complex. Impacts of improperly regulated flows include a) destruction of eggs and fry, b) direct and indirect mortalities to adults, c) effects on water quality and, d) flow-related mortalities to juvenile migrants.

a) Destruction of Eggs and Fry. In free flowing river sections such as the Hanford area below Priest Rapids Dam, instantaneous flows directly control water level. Avery important race of fall chinook which spawns in this area is affected by the extensive water level fluctuations from the Priest Rapids Dam peaking operation. Even low water levels of short duration can have the following impacts on fish production:

(1) They reduce the effective spawning area.

(2) They dewater and destroy eggs in the gravel.

(3) They trap fry in the gravel just before emergence and kill them by exposure.

(4) They strand fry in pools where they are killed by lack of oxygen, by exposure to air, or by bird predation.

Studies by the Washington Department of Fisheries have verified severe fishery losses at the minimum flow level permitted by the Priest Rapids license (36,000 cfs) and have supplied some evidence supporting a minimum instantaneous flow of 70,000 cfs. In the 1977-78 season the spawning areas covered by 36,000 cfs, 50,000 cfs, and 70,000 cfs were noted.

From the results of this and other observations, it has been demonstrated that considerable spawning occurs above the 36,000 cfs level. This spawn is then subject to exposure when flows drop to 36,000 cfs.

The section of the Columbia River below Priest Rapids Dam is the last uninundated, nontidal segment of this stream in the U.S. It is also the last remaining natural spawning area for fall chinook on the main Columbia River and supports the largest population of wild fall chinook in the Columbia Basin. Peaking operations forecast for the future would destroy the productivity of this area.

b) Direct and Indirect Mortalities to Adults. Studies conducted by the Oregon Department of Fish and Wildlife for the Corps of Engineers and by the NMFS have demonstrated that hourly and daily peaking operations can delay adult passage. Serious mortalities can result from such delay. If the adults do not reach the spawning area in a timely manner, they do not successfully spawn, thereby reducing the number of juveniles available to maintain the species and provide for recreation, Indian ceremonial and subsistence fishery as well as a commercial fishery.

c) Effects on Water Quality. Volume and seasonal distribution of flow can influence temperature, point and nonpoint source pollution, and nitrogen supersaturation. Major concerns to fisheries are alterations of water quality which can block the migration of both adults and juvenile salmonids, affect the incidence of fish disease, alter the species composition favoring some species over others, and particularly impact the productivity of the Columbia River estuary. Refer to section IV.B.4 for the impacts associated with water quality.

d) Flow-related Mortalities to Juvenile Migrants. Juvenile salmon and steelhead migrating to the ocean must adhere to a very critical time schedule. If delay disrupts this schedule, serious mortality will occur. This is primarily due to the effect of delay on the smoltification process. Smoltification is a physiological state which exists in juvenile salmon and steelhead for a limited period of time. During this period, juveniles (smolts) are motivated to migrate downstream and are physiologically capable of adjusting from a freshwater to a saltwater environment.. Research by National Marine Fisheries Service (NMFS) shows that for steelhead, nonmigratory juveniles (parr) undergo a transformation to smolts when reared in water temperatures below 53°F. Conversely, smolts revert to parr if exposed for significant periods to water temperatures above 54°F. Temperatures above 54°F are regularly reached in the Columbia River by mid-May. Consequently, since smolts usually begin active migration in the Snake River in mid-April, they must move quickly through the main stem river if the impact of reversion level temperatures is to be minimized.

Regardless of temperature, steelhead smolts will revert to parr by late June if they remain in freshwater. In the adjustment from freshwater to saltwater, survival drops from almost 100 percent for steelhead smolts to about 20 percent for juvenile steelhead that have reverted to the parr stage. The situation is similar for juvenile salmon. Refer to Appendix F for information on fish biology.

Delayed fish that take up residence in the reservoirs include "residuals" that never go to sea (and, therefore, do not contribute to adult fisheries) and "holdovers" that complete their migration after an extended residence in fresh water. Studies of scales which record the duration of freshwater residence indicate that very few spring chinook holdovers survive to return as adults. In 1977, about 50 percent of the juvenile chinook and steelhead from the Snake River tributaries never passed Lower Granite Dam. Purse seining operations of NMFS indicated that massive numbers of these fish were present in the Lower Granite pool, and very few of those delayed beyond the normal passage time ever passed Lower Granite Dam.

Extensive studies funded by the Corps of Engineers and NMFS substantiate the above evidence by relating delay and mortality of juvenile chinook and steelhead to Columbia and Snake River flows. Flows were classified as "low," "moderate," or "high" as follows:

	Low Flows (1000 cfs)	Moderate Flows (1000 cfs)	High Flows (1000 cfs)
Snake River	30-50	80-100	120-180
Columbia River	150-180	200-300	350-500

Travel time in passing a chain of eight dams on the Snake and Columbia rivers was used as a measure of delay. The time varied from 23 days in high flow years to 41 days in moderate flow years to 69 days in low flow years. Flow-related mortalities associated with these migration rates varied from 35-45 percent for high flow years to 40-65 percent for moderate flow years to 70-85 percent for low flows years. The studies also indicated that mortalities are less in the free-flowing river section than through the reservoirs in high flow years.

Since 1966, studies funded by the Corps of Engineers and NMFS have estimated mortalities incurred by juvenile migrants from the uppermost dam on the Snake River to dams on the lower Columbia River. These studies encompass a wide range of flows and permit relating the overall survival past eight dams to Columbia River flows under existing operations (Figure 5). Other extensive studies have been made on turbines at Corps of Engineers' dams which estimate direct turbine mortalities, spillway mortalities, and predation losses on juveniles exiting from turbines.

From this, "turbine-related" losses (Figure 5) can be estimated as a function of flow which governs percentage of water spilled and turbidity, which in turn influence predation . Finally, from these curves one can directly estimate all other losses in passing through the eight reservoirs which are labeled "flow-related" losses in Figure 5 (i.e., Overall Survival = Flow Related Survival x Turbine Related Survival).

2. Other River Uses

There are flow related impacts on the other uses of the river also. Wildlife and resident fish are dependent on minimum instantaneous flow a levels to maintain their habitats. Table 18 shows the Washington State Department of Game's recommended flows and forebay elevations for wildlife. The riparian habitat along the river banks is damaged by widely fluctuating flow conditions. Refer to section IV.C.1 Control of Pool Fluctuation for impact information in this area. Recreation impacts associated with fluctuation in water level are also discussed in the referenced section.

TABLE 18
Washington Department of Game
Recommended Instantaneous Minimum Flows
At Designated Forebay Elevations Dueing
Critical Wildlife Use Periods

Critical Wildlife Use Period
February 1 through July 31

Recommended Minimum Flows at Specified Forebay Elevations

Project	Forebay Elevation (Ft. MSL)		Instantaneous Minimum In Flow (Cfs)
Below Bonneville	-	with	130,000
Bonneville Pool	73	with	70,000
The Dalles Pool	157	with	70,000
John Day Pool	263	with	70,000
McNary Pool	337	with	70,000
Hanford Reach*	-	with	60,000
Priest Rapids Pool	483	with	60,000
Wanapum Pool	565	with	60,000
Rock Island Pool	609	with	60,000
Rocky Reach Pool	705	with	60,000
Wells Pool	774	with	60,000
Chief Joseph Pool	946	with	60,000

*These are flowing stretches of Columbia River; Forebay elevations are not applicable.

In addition, recreation is affected by velocity changes that can be caused by the dam operations. Rapid changes in the flow can alter the velocities which, in turn, can be detrimental to the safety of boaters, swimmers, and fishermen. This impact is difficult to quantify as no studies have been made in this area. The theoretical curve shown in Figure 7 represents a potential way to relate velocity to the suitability of the reservoir for recreational activities.

Figure 7

Suitability FOR WATER DEPENDENT RECREATION

Source: (Hyra, 1978)

Navigation is another flow-related use of the river. Again the primary impacts on navigation have to do with changes in water level that can affect the docks and expose hazards. These are also discussed in section IV.C.1.

The impact on power generation is greatest in relation to maintaining minimum instantaneous flows because the water must be continuously run through the system whether power is required at that moment or not. Such overgeneration impacts can be reduced by scheduling maintenance. outages on other plants for periods when high fish flaws are required. Excess power can be "stared" with utilities inside and outside the basin for later return, although this method of storage involves certain costs and losses (see discussion under Valuation of Impacts below). With average daily flow requirements, however, the water can be run through the turbines when the power is needed (at peak use hours) as long as the 24-hour average flow is maintained.

The ability to use the Columbia River System to provide peaking power is becoming increasingly important as power demand increases in the Pacific Northwest. Nuclear and other thermal power plants are most efficiently operated at a constant generating level and, therefore, are used to provide base load capacity. Hydropower generation can be easily varied to respond to changes in demand throughout the day. Therefore, the Columbia River is being used for peak power generation.

The alternatives available under this option include varying levels of average daily flow and varying levels of instantaneous flow. The alternatives that have been considered for this program are shown in Table 19 and 20 along with the corresponding impacts. If an effective energy conservation program were implemented, impacts on power generation could be restricted or delayed.

In low water years, the minimum instream flow levels could be subjected to a reduction to share the burden. This reduction in flow levels (called the critical flow adjustment) would reduce the impacts on power generation in critical water years. The maximum proposed reduction in minimum flow levels is 25 percent in years when the forecasted runoff is 52.5 million acre-feet or less. If the forecasted runoff is 88 million acre-feet or more, no reduction in minimum flow levels is proposed. See Figure 8 for the relationship of reduction to forecasted runoff for intermediate values.

Critical flow adjustments will be based on forecasted runoff for April through September. Runoff forecasts are issued by the Soil Conservation Service in Water Supply Outlook of Washington State. Every year, five forecasts are issued as of the first day of January, February, March, April, and May. Among the stations for which forecasts are published is the Columbia River at The Dalles, Oregon. Figure 9 in the Program Document provides a comparison of the forecast and observed flows at The Dalles for the 1977, 1978, and 1979 forecast periods. It is proposed that forecasts for this station be used to determine whether critical flow adjustments may be required by the director in any given year.

The forecasted runoff figures are not anticipated gaged flows but include water that will be captured in major upstream storage reservoirs and water that will be pumped into the feeder canal for the Columbia Basin irrigation project at Grand Coulee Dam. These flows may be referred to as "basepower flows." Gaged runoff is affected by storage at 14 major reservoirs, including Coeur d'Alene, Cootenay, Flathead, Roosevelt (Grand Coulee), Hungry Horse, Pend Oreille, Noxon, Ducan, Mica, Libby, Upper Arrow, Lower Arrow, Brownlee, and Dworshak reservoirs and by the Columbia Basin Project diversion as well as by other out-of-stream diversions.

Forecasted runoff, therefore, for these stations is runoff (in acre-feet) that would occur during the April through September period if storage in these reservoirs and diversion at Grand Coulee did not occur. Note that the effects of upper Snake River major storage and diversion, other diversion, and storage throughout the Columbia Basin, or for natural storage in soils, aquifers, wetlands, or natural lakes are not specifically recognized in the model, but are taken as given.

The forecast proposed to be used to determine the critical flow adjustment required will be the April 1 forecast of April through September unregulated runoff at The Dalles. Critical flow adjustments may be invoked by the director when, in his opinion, the public interest will be served by a percentage reduction in minimum flows provided that the April-September forecasted flow at The Dalles is less than 88 million acre-feet. When the forecasted flow is greater than or equal to 88 million acre-feet no critical flow adjustments will be required.

TABLE 19
Fishery Impacts of Flow Options (millions of 1977 $'s per year)

Flow Option	Fishery Impacts
1. COFO – 1979	Baseline Case
2. C.R.F.C.[2]	+34.4 to +59.4
3. W.E.C.	+43.1 to +77.4

NOTES: 1. Range of fishery impacts derived by assuming that increases in sport fishery occur as increased catch per day at estimated historical fishing days (low), or increased fishing days at estimated historical catch rates. Commercial fishery impacts added in each case. Values shown are increments over baseline.

2. Fishery impacts of C.R.F.C. flow recommendation also applied to DOE program proposal.

TABLE 20

Power Impacts of Instream Flows[1] (millions of 1977 $'s per year)

Flow Option	Critical Flow Values			Annual Expected Values [2]		
	Columbia	Snake	System	Columbia	Snake	System
1. COFO - 1979	---------- Baseline Case ----------					
2. DOE Proposal						
Overgeneration						
(a) 100% acceptability	$ 11.2	$ 2.0	$ 13.2	$ 1.7	$ 0.3	$ 2.0
(b) 75% acceptability	20.0	3.5	23.5	3.0	0.5	3.5
(c) 25% acceptability	36.8	6.5	43.3	5.5	1.0	6.5
Peaking Capacity	9.6	2.4	12.0	9.6	2.4	12.0
Total						
(a) 100% acceptability	$ 20.8	$ 4.4	$ 25.2	$ 11.3	$ 2.7	$ 14.0
(b) 75% acceptability	29.6	5.9	35.5	12.6	2.9	15.5
(c) 25% acceptability	46.4	8.9	55.3	15.1	3.4	18.5
3. C.R.F.C.						
Overgeneration						
(a) 100% acceptability	$ 33.4	$ 8.4	$ 41.8	$ 5.0	$ 1.3	$ 6.3
(b) 75% acceptability	59.1	14.9	73.9	8.9	2.2	11.1
(c) 25% acceptability	110.5	27.6	138.1	16.6	4.1	20.7
Peaking Capacity	20.8	5.2	26.0	20.8	5.2	26.0
Total						
(a) 100% acceptability	$ 54.2	$ 13.6	$ 67.8	$ 25.8	$ 6.5	$ 32.3
(b) 75% acceptability	79.9	20.1	99.9	29.7	7.4	37.1
(c) 25% acceptability	110.5	32.8	164.1	37.4	9.3	46.7

NOTES 1. The assumptions and unit values upon which this table are based include:

- transmission loss of 16 percent (8 percent each way) on overgeneration
- replacement of transmission and acceptability loss at $0.02/kwh and storage charges of $0.002%kwh; gas turbine peaking capacity at $30.00/MW/yr.

2. Expected values calculated via critical flow values and probability weight of 0.15 (provided by BPA)

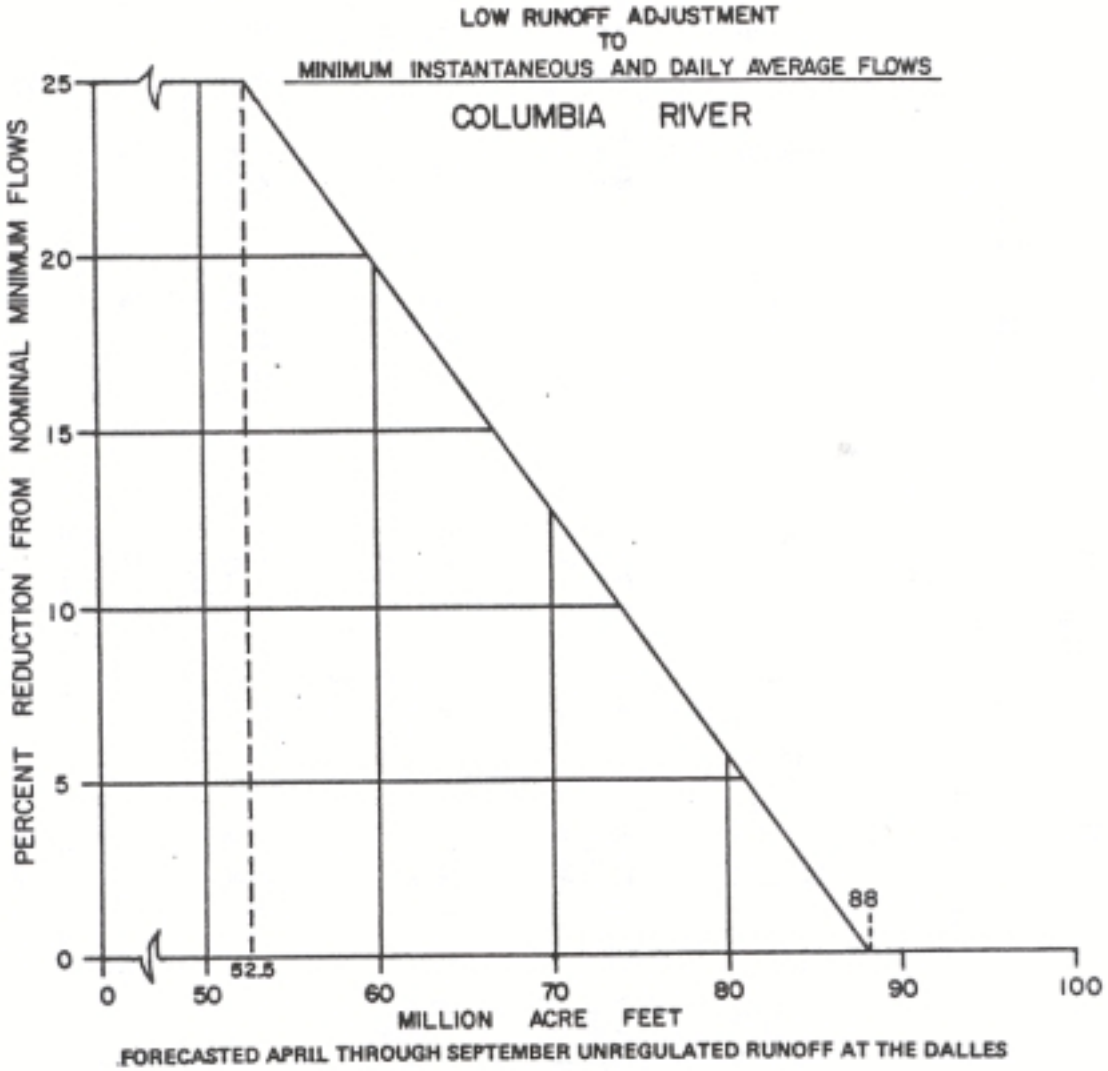

LOW RUNOFF ADJUSTMENT
TO
MINIMUM INSTANTANEOUS AND DAILY AVERAGE FLOWS
COLUMBIA RIVER
PERCENT REDUCTION FROM NOMINAL MINIMUM FLOWS
25
20
15
10
5
0
52.5
88
0
50
60
70
80
90
100
MILLION ACRE FEET
FORECASTED APRIL THROUGH SEPTEMBER UNREGULATED RUNOFF AT THE DALLES

Figure 7

The department will monitor runoff forecasts made prior to April 1 in order that adequate warning may be disseminated to affected parties that an impending water supply shortfall is expected. However, the April 1 forecasts will be used to determine whether cutbacks may be required and, if so, will also be used to determine the actual adjustment percentage. Notification of affected diverters will be made as soon as possible following such a determination.

If the May 1 forecast indicates a changed projected runoff condition from the April through September period forecast, the department may reduce the critical flow adjustment.

Figure 9 is a scatter diagram of modified runoff volumes (forecast equivalent) for April through September for the years 1879 through 1979. The lowest year is 1926 with 50 million acre-feet. Nearly as low was 1977 with 54 million acre-feet. The critical flow adjustment thresholds included in the figure provide an indication of the frequency with which critical runoff adjustments would be required. According to statistical calculations, the April through September modified volume runoff exceeds 52.5 million acre-feet about 98 percent of the time and exceeds 88 million acre-feet about 60 percent of the time.

The means of implementing the requirement for minimum instream flows are the same as those outlined in section IV.B.3. Basically, the State of Washington can adopt a policy that certain minimum flow levels are necessary to protect instream resources. Implementation of this policy with its minimum flow levels can then be accomplished through provisions attached to water rights, negotiations with project operators, federal project reauthorizations and/or Federal Energy Regulatory Commission orders as the opportunities arise, or the adoption of administrative regulations.

B.6.c. Valuation of Impacts

Estimates of the economic impacts associated with selected flow options are displayed in Tables 19 and 20. The following notes should be borne in mind as this information is reviewed:

1. The electrical energy impacts reported in this section are substantially revised from those in the first draft of this EIS. This is due to the fact that considerable additional information has been provided by power agencies -- notably, the Bonneville Power Administration.

2. As with the analysis of Spill Options, the estimated power impacts provided here are based upon the assumption that energy or generation capacity (as appropriate) losses implied by each Flow Options considered would be replaced at constant, 1977 price levels. No attempt has been made to assess the impacts of the extremes on the range of possible outcomes -- i.e.; reduction of energy loads via conservation measures, or complete loss of the energy/ capability associated with the Flow Options analyzed here -- upon the economic performance of the region. Consideration of these alternatives would substantially reduce or increase, respectively, the estimated impacts shown in this EIS.

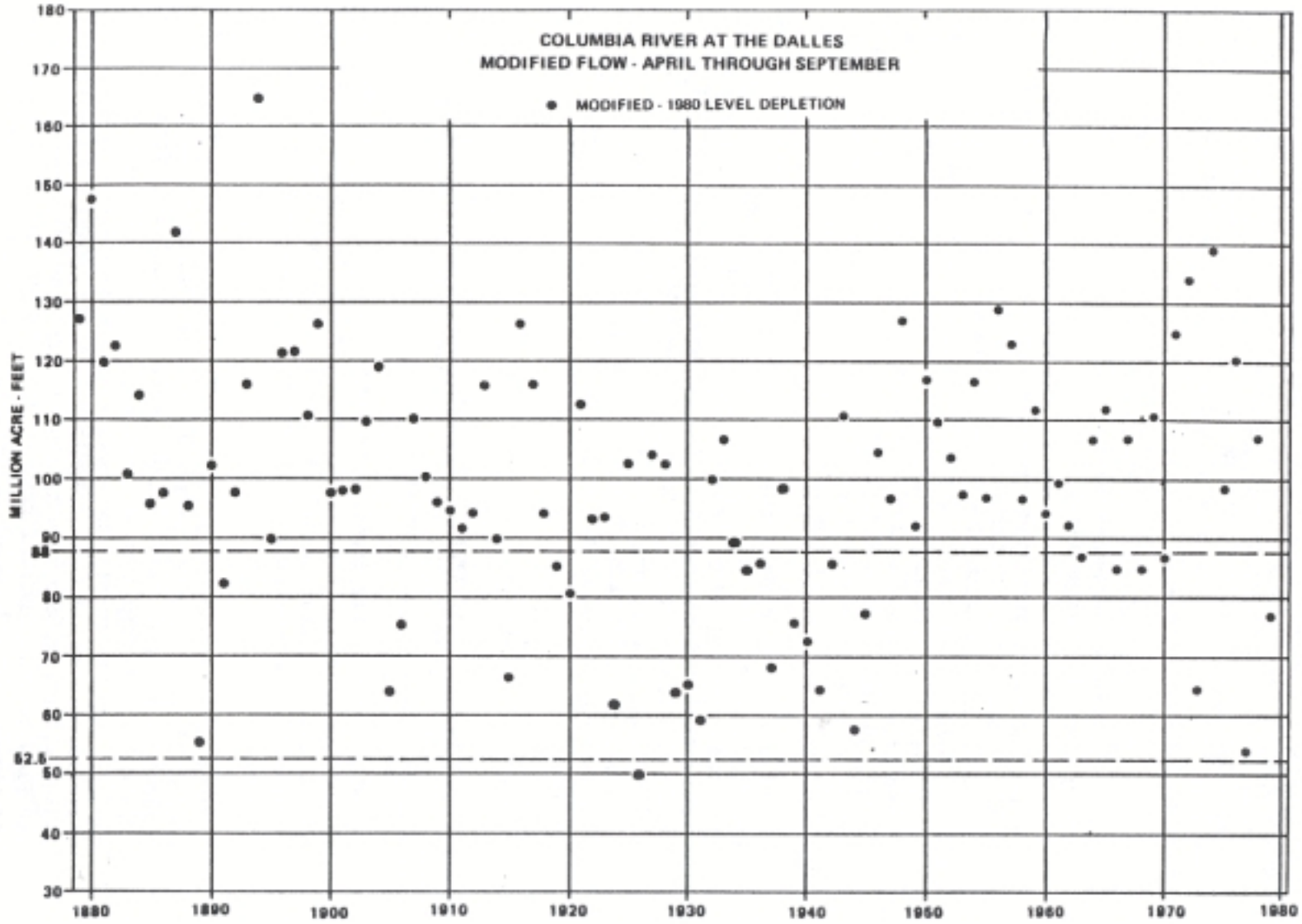

COLUMBIA RIVER AT THE DALLES
MODIFIED FLOW - APRIL THROUGH SEPTEMBER
MODIFIED - 1980 LEVEL DEPLETION
MILLION ACRE - FEET
180
170
160
150
140
130
120
110
100
90
88
80
70
60
52.5
50
40
30
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980

Figure 8

The ways in which minimum flow requirements benefit fisheries (and other instream water uses) have been described above. This economic analysis focuses upon one aspect of fishery enhancement -- improved survival rates for downstream-migrant smolts. Improvements in smolt survival were estimated via the curves provided by the Columbia River Fisheries Council (Figure 5), in conjunction with the spill levels obtained by the Committee on Fisheries Operations in 1979 (COFO - 1979). COFO-979 spill and flow conditions were also treated as the baseline against which other flow options were assessed.

Impacts upon returning adult runs, commercial, and sport catches, and monetary values were estimated via the same procedures and frameworks as were used for the analysis of Spill Options. The fisheries impacts reported in Table 19 are increments with respect to the baseline.

The dollar magnitudes of the estimated effects of selected minimum flow requirements upon energy and generation capacity are shown in Table 20. The basis upon which these impacts were derived is summarized below.

Minimum Average Daily Flows

Minimum average daily flow requirements cause "overgeneration" within the Columbia/Snake hydroelectric system. This occurs when water is passed through generators at times other than when needed to satisfy regional power demands. At the outset, it should be noted that the impacts of average daily flows provided to facilitate fish passage differs with the level of runoff. During periods of low runoff, the water passed through the system under minimum average daily flow requirements (for fish passage) would, probably, be stored for subsequent regional generation. In years of higher .(i.e., "normal" or "average") runoff, the amount of water flowing downstream typically exceeds the storage capacity of the system. Thus, overgeneration tends to occur in any event, and the fish whose downstream passage is aided by instream flows are (wholly or in part) "free riders." Overgenerated energy would either be sold in secondary markets, within or outside of the region, or would be stored in power systems outside the Pacific Northwest for later return. Since the latter is more likely to be the case in low runoff periods, this analysis is based upon assumed storage/return.

In these circumstances, three kinds of losses (or costs) are imposed upon the regional power system. These are:

- transmission losses, as the overgenerated energy is sent to and returned from the system in which it is stored, and;

- acceptability losses, which occur when the storing system may return the stored energy at its option, and chooses to do so at a time when not all of the stored energy can be utilized within the Pacific Northwest region, and;

- storage charges on the net amount of energy stored outside the region.

Acceptability losses are difficult to assess with any degree of precision at this time. This is due to the fact that we have but two years' experience with flows provided specifically for fish passage -- 1977 and 1979. In both of these cases, all of the energy stored outside the region was acceptable when it was returned (net of transmission losses). However, there is good reason not to expect this to continue into the future because of the changing nature of this area's electrical power system. Current trends point toward the regional base load being increasingly satisfied via thermal generation, with the hydroelectric system serving proportionately more as a peak load resource. These trends are not being borneout in fact as quickly as was originally predicted; for various environmental and economic reasons, thermal plants are not being built at the anticipated rate. Thus, return of stored power during nonpeak periods may well imply a nonzero acceptability loss.

In the absence of a good way to "forecast" this phenomenon into the future, Table 20 provides a range of estimated impacts, bracketed at the low end by 100 percent acceptability of the stored energy (0 percent loss), and at the high end by 25 percent acceptability (75 percent loss). An estimate for 75 percent acceptability (25 percent loss) is provided as an estimate of future conditions under the circumstances described above.

Minimum Instantaneous Flows

Minimum instantaneous flows impact the capability of the regional hydroelectric system to meet the daily, weekly, or seasonal peaks in area demands for electrical energy. This gives rise to a "plant capacity" problem similar to that faced by many industries which require large-scale capital investments in plant and equipment (e.g., steel mills). The physical plant must be large enough to satisfy the greatest demand for output expected over the planning period, even though some part of this capacity will stand idle for greater or lesser amounts of time. In this case, minimum instantaneous flow requirements imply a need for the region's electrical energy generation system to invest in nonhydro peaking resources to be held on "standby" for those cases where the hydroelectric system is unable to meet peak demands.

The Analysis

The dollar amounts shown in Table 20 are based upon information provided by the Bonneville Power Administration (BPA). BPA staff have developed estimates of the overgeneration-related and peaking capacity losses associated with two of the Flow Options under consideration -- the minimum flow recommendations of the Columbia River Fisheries Council, and the proposal put forth by the Department of Ecology in this program. These are the flow provisions of Alternatives C and F, respectively, in Table 21. Time did not allow a detailed analysis of the impacts associated with the recommendations of the Washington Environmental Council nor the optimum flows of the CRFC. However, it is fair to say that both proposals would provide somewhat greater benefits to fish and wildlife and would result in greater impacts on power production. Valuation of impacts is based upon 1977-level thermal generation costs for replacement of the energy impacts of overgeneration (transmission plus acceptability losses) plus storage charges. As with the power impacts associated with various Spill Options, generation -- or bus bar -- costs are taken to represent the incremental costs incurred by regional power consumers as hydrogeneration is replaced with thermal energy, thus providing a measure conceptually comparable to the incremental fishery impacts found in Table 19. Replacement of lost hydrosystem peaking capacity is valued in terms of the next-best alternative peaking resource -- the investment costs of gas turbines. (See Table 20 for unit values used.)

The information provided by BPA evaluated the overgeneration and capacity effects of the indicated flow requirements on a base of critical period runoff conditions (1929 - 1932) against 1985-86 load conditions. It also provided these impacts for the combined Columbia and Snake River systems. For these reasons, Table 20 contains the following special features:

- Energy (overgeneration) impacts are presented under both critical period and annual expected value conditions. This is because, as noted earlier, overgeneration on account of flows provided specifically for fish passage is a relatively rare event, occurring only under low runoff conditions. Thus, the annual expected value impact estimates (derived by weighting the value of critical period over-generation by its historical frequency of occurrence), provides a rough estimate of the "implied" annual power impacts upon the region of providing minimum average daily flows for fish passage. These amounts correspond to the annual values reported for fishery impacts. (Of course, in the event that a critically low runoff does occur in the Columbia System, the values reported for critical period conditions would then pertain.)

  The investment costs of replacement of lost hydroelectric peaking capacity remain the same under critical period and annual expected value conditions. This is because the requirement in this case is to have the necessary capacity in place to meet peak loads if and as they occur. This cost would (presumably) be incurred in any event.

- The analysis provided by BPA was framed, as noted, in terms of the combined Columbia/ Snake River hydroelectric system. Since the department's proposed program applies only to the main stem Columbia, these impacts are reported separately for each river, as well as in total. (It is not altogether clear that a satisfactory functional separation between the two parts of the Columbia system can be made either in terms of electric energy generation or in terms of fisheries.)

B.7. Harvest Management

The harvest management option involves controlling the numbers of salmon caught in commercial and sport fisheries to insure a certain level of escapement for propagation. The goal of harvest management is to maintain a sustained and optimum yield. The optimum yield is a balance between economic factors, food production, recreation, cultural values, and biological productivity.

B.7.a. Existing Conditions

The states regulate the fisheries within their respective boundaries by setting catch limits, size limits, season length, and gear restrictions.

Ocean harvest management is a complex issue with shared responsibilities. The Pacific Fisheries Management Council is responsible for drafting management plans for all fisheries resources in the range from 3 miles to 200 miles of the coastline of Washington, Oregon, and California. Such plans are submitted to the Department of Commerce for approval and implementation. The Council is made up of representatives from the states of Washington, Oregon, California, Idaho, and Alaska, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the U. S.

Coast Guard, the U.S. State Department, and the Pacific Marine Fisheries Commission. Alaska, U.S. Fish and Wildlife Service, U.S. Coast Guard, the U.S. State Department, and the Pacific Marine Fisheries Commission are nonvoting members of the Management Council. The tools used for harvest management include regulating the size limits, length of season, quota limits, area restrictions, and gear restrictions. There is also some effort being made toward controlling the number of fishing licenses available. Currently this function is being handled by each state.

The respective states are responsible for harvest management within the 3-mile limit.. However, their management schemes must be consistent with the Pacific Fisheries Management Council efforts. The same basic management tools are employed.

Harvest management for upriver bound stocks originating above Bonneville Dam in the Columbia River is in accordance with the court ordered management plan. This plan is included in total in Appendix G.

The graph shown in Figure 10 shows the Columbia River catch of salmon and steelhead for the period of 1866 to 1975. As can be seen, there has been a substantial reduction in catch and run size since the early part of the century. Runs have declined as a result of a variety of reasons including overfishing and habitat degradation. The recovery of the runs has been hampered by the passage problems at the dams and by destruction of natural habitats.

B.7.b. Alternatives and Impacts

The alternatives of 1) "no-action," 2) reopening selected harvests, 3) closing additional harvests, and 4) placing selected species on the endangered species list were evaluated for each stock of anadromous fish in the Columbia River. Regarding the alternative of placing selected species on the Endangered Species List, the Washington Department of Game stated in their comment letter: "Placement of selected species on the endangered species list is not truly an option. If professional review indicates such placement is appropriate, it must take place." The National Marine Fisheries Service and the Fish and Wildlife Service are now conducting such a review.

The four alternatives are discussed below for each stock. (This information was provided by the Washington Department of Fisheries with related input from other fish and wildlife agencies.)

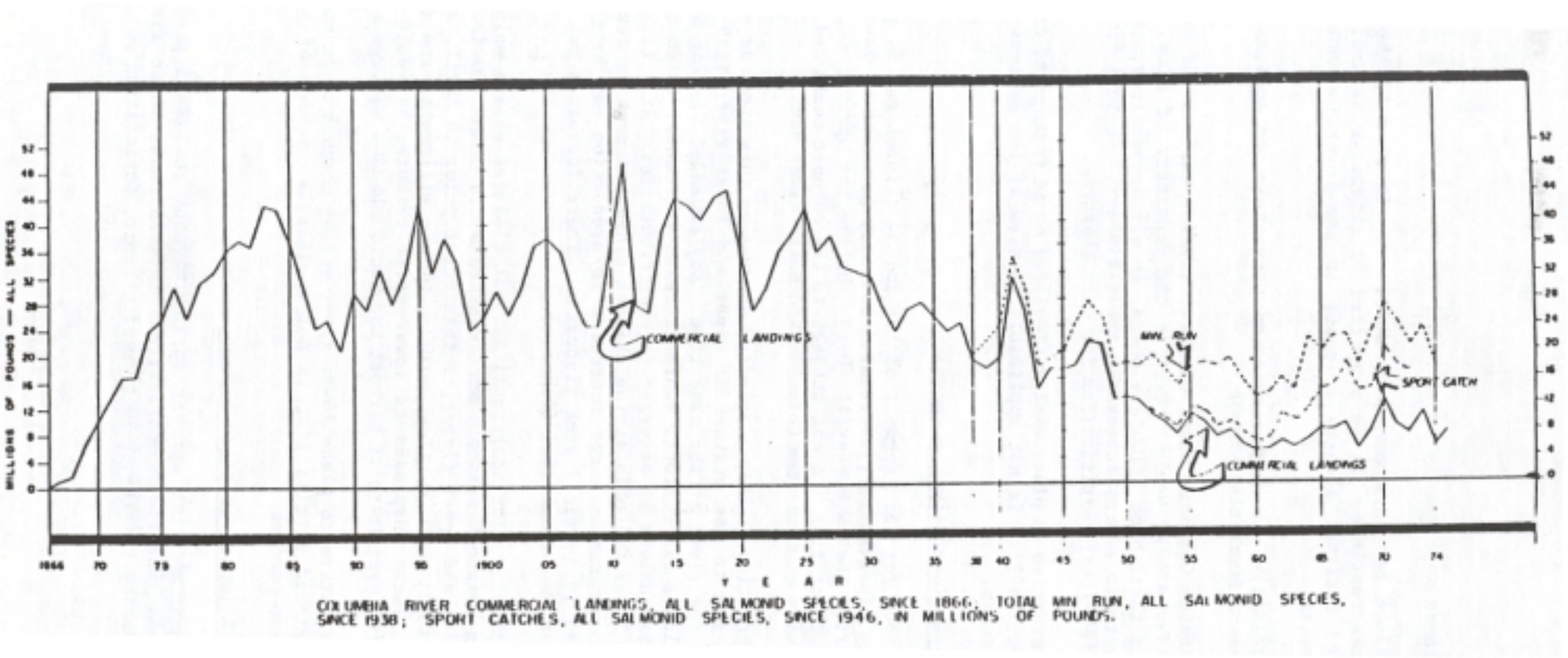


Figure 9

Source: PNRC, Investigative Reports of Columbia River Fisheries Project, July 1976, p. E-4.

Winter Steelhead

1. The outlook for this generally stable run is good if the current practices continue. It is supported by extensive natural production and massive hatchery releases in the lower Columbia River tributaries.

2. The alternative to reopen selected harvest is not applicable with the present favorable outlook.

3. Any mainstem Columbia River closure, say for the sake of protecting a specific stock, would result in the remainder of mixed stocks reaching their home tributary where, in all probability, they would contribute to a very successful sport fishery. At this time there is no biological justification for such closures.

4. The alternative to place winter steelhead on an endangered or threatened species list is not applicable in view of the present production success.

Spring Chinook (lower river segment)

1. The outlook for this segment of the spring chinook run is good due to large, increasingly successful hatchery programs on lower river tributaries (below Bonneville Dam). Unlike the upriver segment, of course, these fish are not subject to the chronic adult and juvenile mortalities at main stem Columbia and Snake River dams.

2. The alternative to reopen selected harvest on this stock is extremely limited due to the mixture of upper and lower river fish moving through the river at the same time. Any expanded fishing opportunity on lower river stocks would increase incidental catch of upper river fish unless it occurred in the tributaries. Effective management of lower Columbia spring chinook hinges in part on recovery of the upriver runs. Large increases in production may have to be harvested in terminal area fisheries. These increases can benefit both sport and commercial fisheries.

3. The alternative for additional harvest closures exists only on the existing "winter" season. Such closure would impact the lower river, commercial and sport fisheries that occur prior to April, and would create additional surplus returns to the Willamette and Cowlitz rivers. These surpluses to lower river tributaries would provide little increase in sport harvest and would add to a wastage situation.

4. The alternative to place lower river spring chinook on an endangered or threatened species list is not applicable in view of present production success.

Spring Chinook (up river segment)

1. The once-productive upriver spring chinook run is in precarious condition. Despite the disastrous 1974-75 runs, these fish have shown amazing resiliency in face of chronic, devastating mortalities suffered at main stem Columbia and Snake river dams. The 1972 run, for example, was the largest recorded since 1938.

There is potential for substantial run recovery and rehabilitation of now-defunct in-river harvest by lower river and Indian commercial fisheries. This will require substantial and expeditious resolution of passage problems at main stem dams and accelerated compensation for past habitat and passage losses. Upper river spring Chinook are harvested by sport fishermen in both the upper and lower river and by ocean sport and commercial fisheries.

Returns to the upper Columbia River (above the Snake River) in the last two years have shown increases, as recorded at Priest Rapids Dam. This might be attributed to increased hatchery production and may indicate a slight upward trend for that segment of the upriver run.

2. Since Columbia and Snake river spring chinook are mixed as they move through lower river fishing zones, there is virtually no opportunity to extend selected harvest on one stock without impacting the other. Also, these upriver fish are mixed with lower river spring chinook below Bonneville Dam. Since steelhead are also present at this same time, any expanded harvest, even with selected gear, could increase incidental catch of that stock.

   Selected harvest might be possible immediately above the Columbia-Snake River confluence. However, this would require dramatic changes in traditional commercial, sport, and Indian fisheries, and undoubtedly would involve extensive litigation. Also, any harvest emphasis this far upstream would result in some fish quality deterioration.

3. The alternative to close additional harvest on upriver spring chinook is not applicable in view of present management practices. The Five Year Management Plan adopted by the federal court (see Appendix G) already provides for total closure of sport and commercial fisheries, along with severe restriction of Indian ceremonial and subsistence fisheries when the run is small.

4. The impact of placing upriver bound spring chinook on an endangered or threatened species list is presently unclear. The extent of harvest constraints has not been defined under the threatened species listing.

   According to the Columbia River Intertribal Fish Commission, the Fisheries Conservation and Management Act requires that the ocean fishery be managed to protect spring chinook. In the main stem Columbia further restrictions that might be possible on upriver fish would be total curtailment of tribal, ceremonial or subsistence fishing or total curtailment of in-river sports fishing.

   If total curtailment of all harvest is required (including incidental catch) when other species or races are capable of being fished, those desired catches would be reduced or lost, creating possible surplus escapements.

   Another potential impact from such a listing involves possible modification of river flow and fish passage control in order to provide maximum protection for these fish.

Summer Chinook

1. The condition of the Snake River segment is particularly precarious. The 1975 Ice Harbor Dam count of 7,200 fish was a record low. The Salmon River redd count was only 6 percent higher than the record low 1974 count.

   Summer Chinook have been the most severely affected of the chinook by destruction and degradation of habitat and chronic adult and juvenile mortalities at main stem dams. However, they have been almost totally ignored by salmon research and artificial propagation efforts.

   The outlook is not good. However, the potential exists for substantial recovery of the summer chinook run. Efforts to increase artificial production effectiveness on summer Chinook are continuing. The fact that summer chinook have not responded to near total in-river fishery closures since the mid-1960's emphasizes the importance of the artificial production programs in attempting to rebuild this once important stock. An extensive sport and commercial fishery harvests than fish at the mouth of the Columbia and throughout their range in the ocean.

2. The alternative to reopen selected harvest would be extremely limited since upper Columbia and Snake rivers summer chinooks are mixed as they move through the lower river. Should run sizes increase to either the upper Columbia or Snake rivers, or should there ever be a lowered escapement demand, selected harvest might be possible immediately above the Columbia --Snake River confluence. Again, this would require dramatic changes in traditional commercial, sport, and Indian fisheries, and would undoubtedly bring about extensive litigation.

3. The alternative to close additional harvest on summer Chinook would be extremely limited. At the present time only a few summer chinook are taken, these by the Indian ceremonial and subsistence fisheries, by incidental harvest in a highly restricted shad fishery, and by a few lucky sportsmen upstream from McNary Dam.

4. The alternative to place summer chinook on an endangered or threatened species list would bring forth a nearly identical situation as with upriver spring chinook salmon. However, if total curtailment of all summer chinook harvest was required, the other stocks moving through the river at the same time would be affected. These include, summer steelhead, sockeye salmon, and shad.

Summer Steelhead

1. The outlook for upriver summer steelhead is good. This run is currently the largest run above The Dalles Dam and has only dropped below 100,000 over Bonneville Dam once in the last ten years.

2. The alternative to expand or reopen selected harvest on summer steelhead is presently restricted by the Five Year Management Plan adopted by the federal court in 1977. This plan provides for incidental catch of steelhead in Indian fisheries, with no targeted commercial fishery. Commercial harvest of steelhead by non-Indians is illegal in both Washington and Oregon. Any reopening of such fisheries would require lengthy legislation and litigation.

   Any expansion of fishing opportunity on summer steelhead would increase the incidental catch of other species present in the river at the same time. These include summer chinook, sport chinook, sockeye, and upriver-bound fall chinook salmon.

3. The alternative to close additional harvest on summer chinook is quite limited, since main stem Columbia sport closures already occur with very low runs. Harvest cuts are being made on this species

by the treaty Indian fishery. Over the last three years, the Indian catch of summer steelhead has been reduced by approximately 80 percent. Closure of special selected terminal harvest in the upper Columbia or Snake River could result in surplus escapements to certain hatcheries.

4. The alternative to place summer steelhead on the endangered or threatened species list appears to be unrealistic as this run is not endangered.

Sockeye

1. Dams have severely reduced sockeye habitat throughout the upper Columbia Basin. Like all upriver fish, sockeye have suffered drastic adult and juvenile mortalities at main stem dams. Because of their small size and lack of sport fishing value, sockeye are not artificially propagated anywhere in the basin.

   The outlook is not good. Nonetheless, sockeye have rebounded from the brink of extinction several times. Substantial resolution of passage problems at main stem Columbia River dams and reintroduction to restore Idaho habitats could stimulate future run recovery.

2. The alternative to open selective harvest on sockeye is virtually impossible, since these fish move through the river at the same time as summer chinook and summer steelhead. Any expanded fishing opportunity for sockeye throughout their river range would increase the incidental catch of these already depressed stocks.

   Potential selective harvest might be achieved in development of different gear types. However, such harvest technology would conflict with traditional commercial and Indian fishery methods, and would require legislation, probably following lengthy litigation.

3. The alternative to close additional harvest is not applicable at this time. Even when existing ceremonial or sport fisheries are operating, the incidental harvest of sockeye is negligible. Virtual total closures are already included in present management practices when low runs prevail.

4. The alternative to place sockeye on an endangered or threatened species list does not seem applicable at this time. Some recent runs (1917) were sufficiently large to provide harvest opportunity. Since the sockeye generally show a greater rebound capability, it is doubtful that such listing will be warranted.

   If sockeye were listed, and required total protection, summer Chinook and steelhead catch, as well as potential shad fisheries, would be impacted by a total closure.

Fall Chinook (upper river segment)

1. The outlook for fish produced above Bonneville Pool is not encouraging.

   Adult fall Chinook counts at John Day, McNary, and Priest Rapids dams were all below average in 1975. The 2,600 fall Chinook counted over Ice Harbor Dam into the Snake River system represented a record low, reflecting the virtual annihilation of this once-productive run by main stem dams.

   Columbia and Snake river dams have virtually eliminated the once vast main stem fall Chinook spawning habitat. Only about 50 miles of the entire main stem Columbia River above Bonneville Dam have not been impounded by dams (the Hanford Reach). Chronic passage mortalities at main stem dams threaten the remaining natural production from the upper basin.

   Fall Chinook, like all other upriver salmon and steelhead runs, would benefit from improved passage conditions at main stem Columbia and Snake River dams. The upriver Fall Chinook currently constitute a large portion of the ocean harvest and provides an inriver commercial fishery and are receiving considerable attention.

2. The alternative to expand or reopen selected harvest is not applicable at this time since present management practice for harvest of upriver fall Chinook is under direction of the Five Year Management Plan adopted by the federal court. Special selected "terminal" harvest is already incorporated where appropriate.

   Any additional main river harvest opportunity would increase incidental catch of coho salmon and summer steelhead.

3. The alternative to close additional harvest would conflict with the Management Plan.

4. The potential for listing Snake River fall Chinook as endangered or threatened is presently being investigated. At this time it appears that this alternative is not applicable.

   Again, the extent of required harvest curtailment from such listings is uncertain. Since the majority of Columbia River fall Chinook are harvested in mixed-stock ocean fisheries from Alaska to California, a potential exists for extreme management conflict under such a listing.

   Any extensive harvest cutback in the river would impact desired Indian and non-Indian catch of more stable runs of upriver fall chinook, as well as the harvest of lower river fall chinook and coho, all of which are mixed as they enter and move through the river.

Fall Chinook (lower river segment)

1. The overall outlook for the combined fall chinook run is good. There is extensive natural and hatchery production in tributaries below and immediately above Bonneville Dam.

2. The alternative to expand or reopen selected harvest of lower river fall chinook is not applicable since runs are in relatively good shape, and their future outlook is bright.

   Additional harvest opportunity may be desired in the near future. To capitalize on this might require earlier openings in September, which would impact upper river fall chinook, and thus conflict with the Five Year Management Plan.

3. The alternative to close additional harvest does not seem applicable in view of the present production success with lower river fall chinook.

   Should there ever be a necessity for closure, the desired harvest of coho salmon would be severely impacted, resulting in extensive surplus and wastage.

4. The alternative to place lower river fall chinook on the endangered species list is not applicable in the foreseeable future.

Coho

1. The outlook for coho is good in the lower river. The run consists primarily of massive hatchery releases in tributaries below and immediately above Bonneville Dam. The upper river segment has had little enhancement but has good potential for rehabilitation.

2. To expand or open selected harvest on Columbia River coho would increase the harvest rates for upriver and lower river fall chinook and Group B summer steelhead in Zone 6 (the Indian Fishery). Since targeted coho harvest requires smaller mesh nets, any attempt to provide additional commercial catch would increase the catch of steelhead.

3. The alternative to close additional coho salmon harvest would result in wastage in the form of surplus hatchery returns. At the same time it would necessitate more restrictive fisheries on other stocks that are in the river at the same time, principally upper and lower river fall chinook. Any significant reduction in harvest on these stocks would also result in surplus hatchery returns.

4. The alternative to place coho on an endangered or threatened species list is not applicable in the foreseeable future. To place any segment of the coho run on such listing would severely impact the desired harvest of other stocks that are available at the same time. These include other coho stocks and upper and lower river fall Chinook.

Chum

1. Index spawning ground counts dropped from an average of 800 fish per mile in the early 1950's to less than 100 fish per mile by 1970. In 1975, 50 fish per mile were counted in selected Washington tributaries, less than half the ten-year mean of 107 fish per mile.

   Chum salmon are the second most abundant species along the whole Pacific rim. The dramatic declines in the Columbia Basin are believed to be largely the result of subtle environmental changes and partly man's encroachment and degradation of spawning areas.

   The outlook for Columbia Basin chum salmon is not good. Fishery protection, rehabilitation, and enhancement programs focus on species of highest sport and commercial value. Chum is not among them.

2. The alternative to expand or open selected harvest on chum is extremely limited, and not applicable for the foreseeable future. Even if some potential was developed for "terminal" harvest, it would undoubtedly conflict with winter steelhead which are migrating at the same time.

3. The alternative to close additional harvest would do little to provide additional fish to spawning grounds, and would severely impart the desired harvest on abundant stocks of coho salmon which overlap with chum in their migration timing.

4. The alternative to place chum on an endangered or threatened species list is probably not applicable since they can and are being produced at some hatcheries on the Columbia. Any extreme harvest curtailment as a result of such listing would severely impact desired harvest on large runs of hatchery produced coho, creating extensive surplus and wastage.

B.8. Habitat Management

Habitat management for this program deals with management of spawning and rearing areas for salmon and steelhead and management of the riparian zone for wildlife. The environmental degradation of the natural fish and wildlife habitats is a serious problem, as no species can survive if its natural habitat is destroyed. The construction of dams on the Columbia and Snake Rivers has significantly altered these habitats. Therefore, salmon and steelhead spawning and rearing now take place primarily in the tributary streams with the exception of the uninundated Hanford Reach of the main stem Columbia River. Wise management and preservation of these areas is essential if fish and wildlife are going to survive man's technological advances.

B.8.a. Existing Conditions

Present habitat management practices for anadromous fish include upgrading of fish ladders at existing tributary dams; improving screening devices at irrigation diversions and ensuring proper screening at new diversions; opening new areas to salmon production, if feasible; maintaining minimum flows for salmon migration, spawning and rearing at existing tributary projects; and protecting the habitat by requiring permits for work in streams utilized by salmon.

Management of the riparian zone is handled by the local governments in Washington under the Shoreline Management Act. For further information on shoreline management, refer to section IV.C.2. In addition, activities within the banks of streams require Hydraulic Project Approvals from the Washington State Departments of Game and Fisheries. Also, the Corps of Engineers manages section 10 (River and Harbor Act of 1899) and 404 (Federal Water Pollution Control Act) permits and the Department of Ecology has responsibility over water quality and quantity and the administration of water rights.

The Washington State Department of Game is currently conducting studies to determine the impacts associated with daily fluctuations in water level in the Columbia River pools. This information will be used by them to negotiate recommended minimum flows and maximum pool level fluctuations for the protection of wildlife resources. This aspect of habitat management is covered in section IV.C.1 -- Control of Pool Fluctuation.

B.8.b. Alternatives and Impacts

There are no real alternatives related to habitat management. The existing programs must be continued, and perhaps improved, to maintain and enhance fish and wildlife resources. Degradation of the natural habitats is a sure way to destroy these resources.

IV.C. Measures for Wildlife, Recreation, and Navigation

C.1. Control of Pool Fluctuation

Fluctuations in water levels and river flows occur upstream and downstream from Columbia River dams when varying volumes of water are run through the turbines to generate power to meet fluctuating power loads. Water levels in the Columbia River have, of course, always fluctuated naturally (especially on a seasonal basis, with relatively slight day-to-day fluctuations), but fluctuations resulting from peaking operation of hydro-plants are faster and more frequent. Tailwater elevation changes of nearly 10 feet per hour have been recorded on the Columbia. Fluctuations in the tailwater elevations below each dam are normally the most severe; fluctuations are damped out as they move downstream, especially at "encroached plants" where the reservoir created by the downstream dam reaches to the toe of the upstream dam.

Fluctuations in river flows and pool elevations affect many uses of the river, including navigation, fish, recreation, and wildlife uses. It may also adversely affect archaeological sites along the river. Excessive fluctuation can adversely affect navigation by making docking facilities unusable and by making it more difficult to know the water depth in some areas. The impacts on fish include stranding of eggs and fry, destruction of spawning and feeding habitat, loss of littoral vegetation, and loss of migratory sense due to velocity changes.

The upper portions of reservoirs are often the most suitable for recreation and wildlife as it is these areas that have suffered the least disturbance -- the depth of inundation is less and the banks tend to be more gradually sloped. The fluctuation in this part of a reservoir, however, is more extreme (in feet of elevation change) and more area is affected per foot of fluctuation. Therefore the upper portion of a reservoir is frequently the area most significantly affected by fluctuations in water level.

Recreational uses of the river can be significantly affected by fluctuating flows and pool elevations. There are waterside parks that are sensitive to elevation changes. Many of these have boat ramps and swimming facilities that can tolerate only a few feet of change. Increased erosion, siltation, debris deposition, and visual degradation may result from increasing flow and water level fluctuations.

Moreover, fluctuation can be a direct threat to public safety as changing currents and water levels make boating, fishing, and swimming hazardous. As the water level rises, sand bars may become islands and people may not be able to reach shore. The potential for such problems can be expected to increase as recreational use of the reservoirs increases.

The graphs shown in Figure 11 have been derived to show the suitability for recreation versus the rate of change in water level and total daily change in water level. They are intended to illustrate general relationships and do not show absolute values.

Another impact of pool fluctuation is the possible elimination of vegetation in the riparian zone. Wildlife losses are directly related to riparian habitat losses and changes in the ecosystem caused by changes in capillary action, soil moisture, erosion, and sloughing. The following paragraphs, provided by the Washington Department of Game, describe the impacts of pool fluctuation on specific wildlife groups.

Waterfowl will be affected by physical alterations of habitat and changes in production of the food chain. Nesting sites and brooding areas for the Great Basin Canada goose are at present very limited along the Columbia and Snake Rivers. Water regulation procedures of power peaking could destroy much of the nesting and brooding habitat that is already in short supply. Islands used by geese for nesting could be reduced in size or totally inundated during nesting season by increased water fluctuation. "Land Bridges" could also result during the low phase of fluctuation and allow predators to destroy goose nests and eggs. This happened recently when McNary Pool was lowered to minimum pool for inspection purposes.

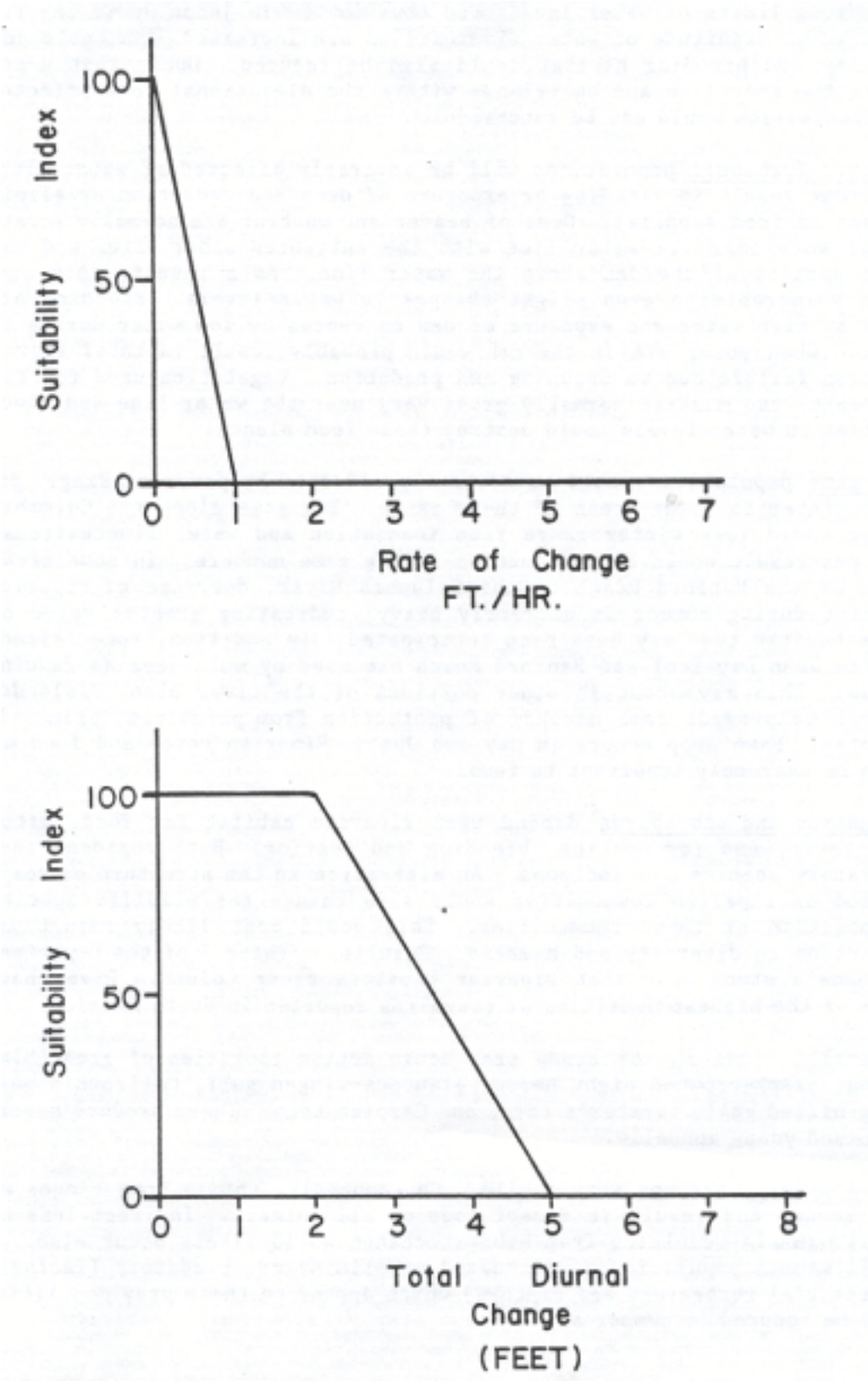


Figure 10 – Suitability For Water Dependent Recreation.

Source: (Hyra, 1978)

Accelerated erosion of nesting islands could also result from peaking operations. Most brooding areas are located entirely within present operating limits of water levels and thus may be in jeopardy if the frequency and magnitude of water fluctuations are increased. Suitable duck nesting and brooding habitat could also be reduced. Ducks that nest along the shoreline and on islands within the elevational zone affected by fluctuation would not be successful.

Aquatic furbearer populations will be adversely affected if water fluctuations result in flooding or exposure of dens and reduction or elimination of food supplies. Dens of beaver and muskrat are normally located at or very near the water line with the entrances under water and the main portion of the den above the water line. As a result, they are very vulnerable to even slight changes in water levels. Flooding of dens by high water and exposure of den entrances by low water during the period when young are in the den would probably result in total reproduction failure due to drowning and predation. Vegetation used for food by beaver and muskrat normally grows very near the water line and fluctuation in water levels could destroy these food plants.

Big game populations could be adversely affected by power peaking. Big game winter in lower areas of their range. Big game along the Columbia River could lose winter range from inundation and water fluctuations. The net result would be a reduction in big game numbers. In some areas, such as the Hanford Reach on the Columbia River, deer-use of riparian habitat during summer is extremely heavy, indicating greater value of this habitat than may have been anticipated. In addition, some islands in the John Day Pool and Hanford Reach are used by mule deer as fawning areas. This may occur in other portions of the river also. Islands appear to provide some measure of protection from predators, primarily coyotes. Fawn drop occurs is May and June. Riparian cover and food may also be extremely important to fawns.

Songbirds and shorebirds depend upon riparian habitat for food, water and cover, and for nesting, brooding and resting. Both resident and migratory species are included. An alteration in the structure or composition of riparian communities would also change the wildlife species composition of these communities. This would most likely result in reduction in diversity and numbers. Results of Phase I of the Department of Game's study show that riparian habitats along Columbia River have some of the highest densities of songbirds reported in North America.

Several islands in the study area house active rookeries of great blue heron, black-crowned night heron, glaucous-winged gull, California gull, ring-billed gull, Forster's tern, and Caspian tern. These produce several thousand young annually.

Small mammals are not very mobile. Consequently, entire home ranges may be flooded and result in direct loss of all animals. Indirect loss of small mammals resulting from habitat change would likely occur also. If small mammal populations are reduced or eliminated; predators (including terrestrial furbearers and raptors) which depend on these prey populations will be reduced in number also.

Loss of vegetation along shorelines could also affect upland game birds such as pheasant, chukar and quail. Critical periods for most upland game birds include nesting and brooding seasons which begin in May and continue through late summer. Young birds need the abundant insects and seeds, cover for protecting them from heat and predators, and water provided by riparian habitat. Winter is also a critical period for upland game birds. Thicker patches of vegetation found along shorelines provide food and protection from predators and cold. Studies show that quail and pheasant use riparian communities year-round.

Reptiles and amphibians depending on insect production along the river or whose territory is flooded by inundation or subject to frequent water fluctuations will also be affected. Stranding and subsequent desiccation of eggs may seriously reduce production of some amphibians and affect predators depending on these amphibians for food. See Figure 12 for a diagram of the Columbia River food chain.

Wildlife-oriented recreation is a function of wildlife abundance and availability. A reduction in quantity or quality of habitat results in a reduction in the abundance and availability of wildlife - thus reducing the incentive and opportunity for related consumptive and aesthetic recreation.

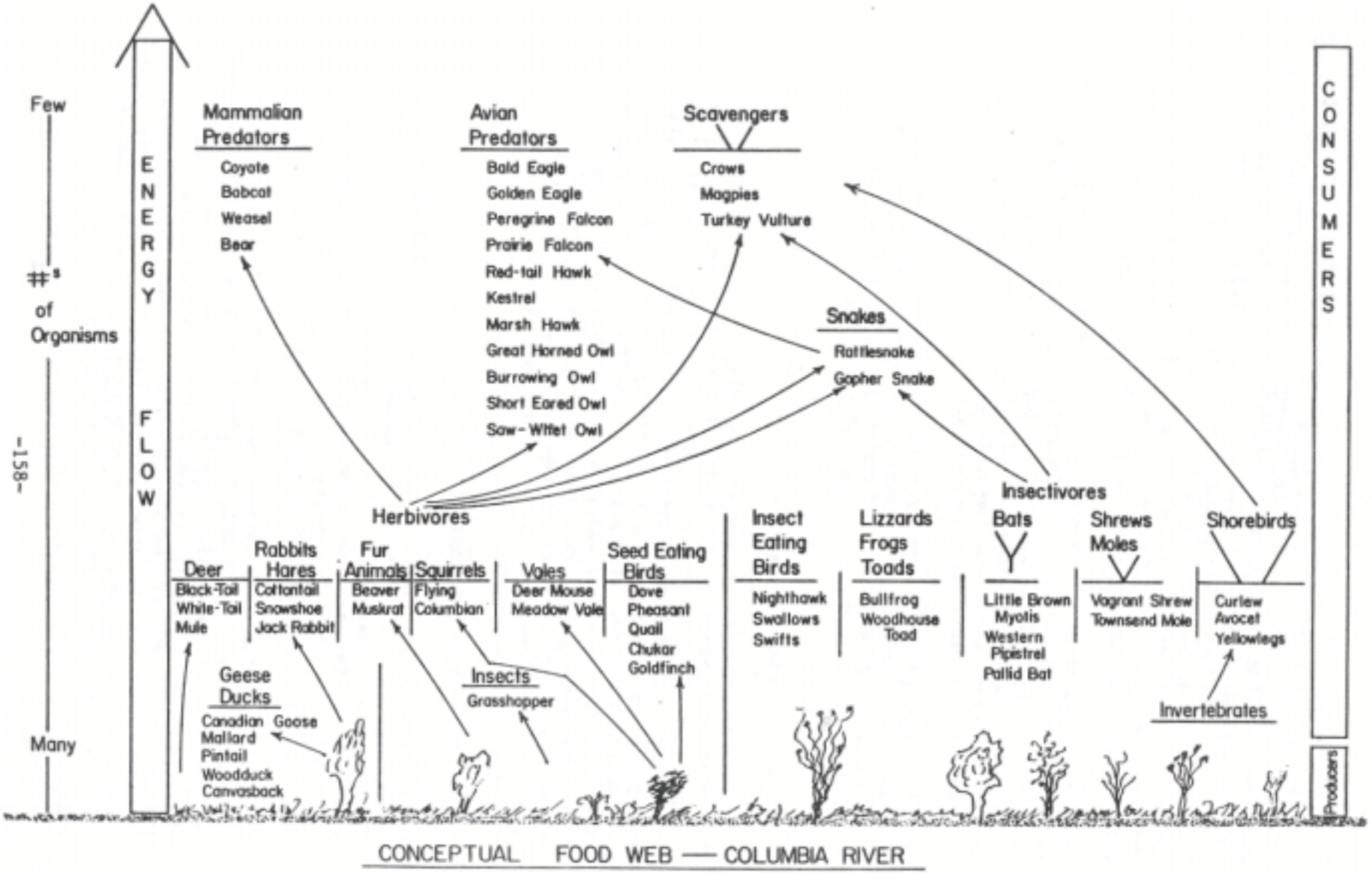
C.l.a. Existing Conditions

There are no controls on changes in forebay or tailwater elevations in the existing licenses or authorizations for the dams, although each of the projects does have established criteria in its operating guidelines. In the past, Columbia River hydroplants have supplied both baseload and peak power and problems associated with flow fluctuations have not been as severe as those now anticipated. Now, with more generating units being added to some of the dams and with more thermal plants being constructed in the Northwest to provide baseload, the Columbia River hydroelectric system is becoming increasingly important as a means of providing peaking power. This will mean greater and more rapid fluctuations in the reservoir levels and river flows.

C.l.b. Alternatives and Impacts

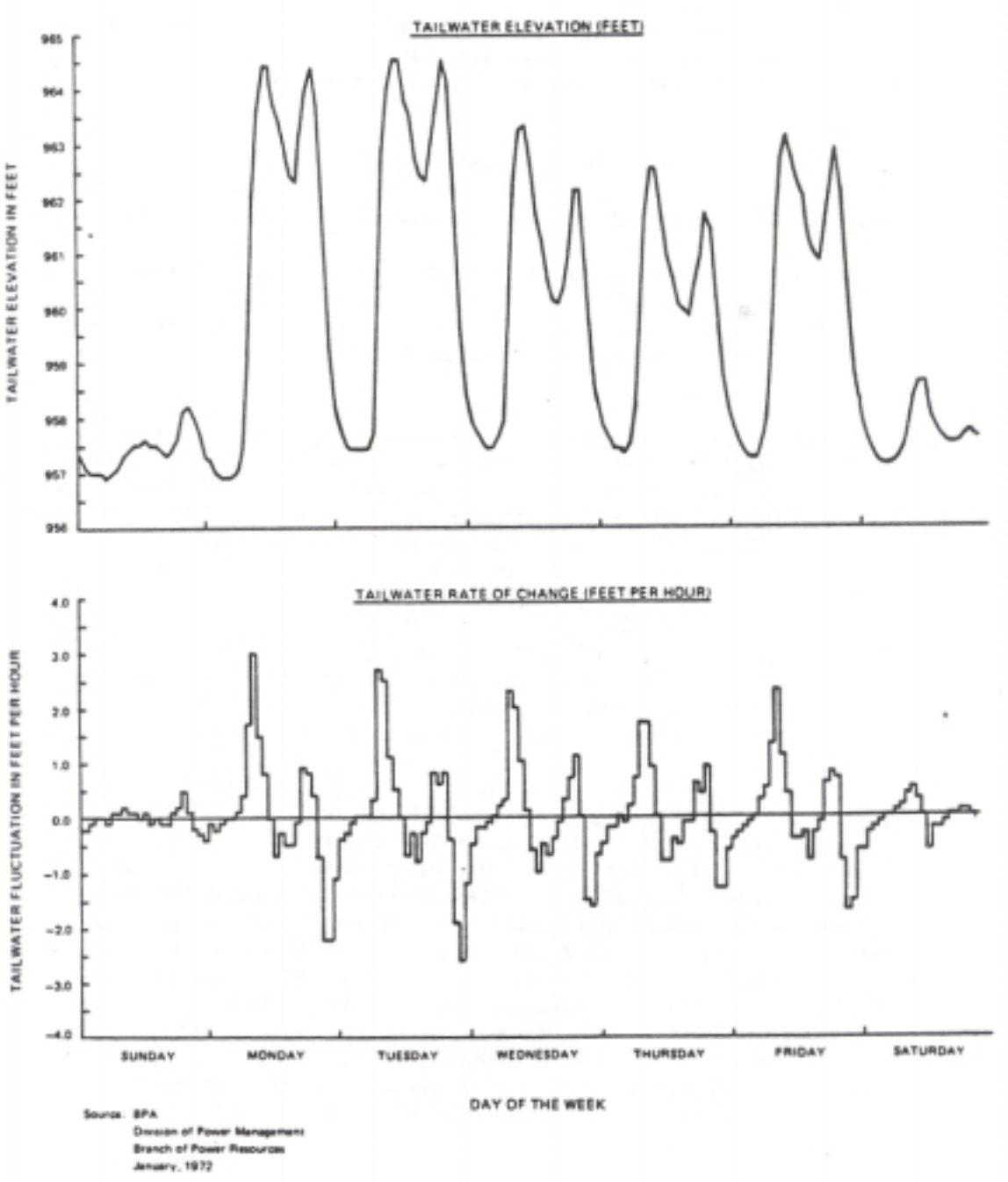
The alternatives available in control of pool fluctuation include "no action" and the establishment of maximum fluctuation levels and rates. The Washington Department of Game is currently under contract to the Army Corps of Engineers to study the effects of pool level fluctuation and to determine allowable levels. This is proving to be a highly complex issue and the data available at this time are very preliminary.

Under the no action alternative, pool level fluctuations would continue and would increase as the Columbia River system is used more intensively for peaking power generation. Under current power planning, daily fluctuations of as much as 15 feet and hourly elevation changes of up to 6.6 feet are projected for the mid-1980's at the base of Grand Coulee Dam according to the U. S. Army Corps of Engineers' January 1977 report entitled Water Surface Fluctuation Studies. Figure 13 shows expected tailwater elevations and rates of change at Grand Coulee for a hypothetical week in April 1990.



CONCEPTUAL FOOD WEB — COLUMBIA RIVER

Figure 11



Source: Bonneville Power Administration, Role EIS, July 1977.

Figure 12 – Tailwater Elevations and Tailwater Rate of Change for Grand Coulee Dam, April 1, 1990

There are several ways in which limitations on pool levels and rates of fluctuation may be established. First, the system operators could simply be required to limit the upper and lower levels and to operate the system in such a way that changes occur at acceptable rates. Such operation limits might require changes in project authorizations and/or FERC license provisions. There are several other possible means of influencing pool fluctuations which are included here as alternatives that are worthy of further discussion and analysis.

Since the demand for peaking power and the suitability of hydroelectric facilities for peaking use have resulted in a trend of increasing pool level fluctuations, one way of limiting the fluctuations is to modify the demand for such energy production. Steps that can be taken include, but are not limited to:

Control of electrical demand in peak periods;

Interruption of aluminum plant loads during peak demand hours;

Limiting of irrigation pumping to nighttime and other offpeak hours;

Providing small and flexible generating plants, including pump storage projects, to minimize the peaking burden on the main stem projects.

The impacts associated with pool fluctuations cannot be quantified until the maximum and minimum pool elevations can be determined. The lack of available knowledge an precise pool profiles and water surface elevations under various flow regimes and forebay elevations has made it impossible for fish and wildlife interests to precisely define maximum and minimum pool elevations. In general, if some control of the total amount and rate of fluctuation is implemented, fish, wildlife, recreation, and navigation would benefit. Since rapid, unexpected pool level fluctuations can also be dangerous to people, human safety would also be improved. The adverse impact would be reduced peak power production and the associated economic losses. The reduced peaking capability could be partially offset by measures to control peak power demand as listed above.

A possible third alternative in control of pool fluctuations could be the designation of certain hydroplants as peaking plants and the remaining plants in the system could assume a lesser share of peaking. System generating stations with a free-flowing river downstream are prime subjects for tailwater restrictions and environmental considerations. The steps of dams (encroached projects) with reregulation capability and slack water hydraulic characteristics could be assigned as peaking plants. Selection criteria for peaking plants, based on the above-mentioned characteristics and others could be formulated for the system. The Mid-Columbia Hourly Coordination Agreement and control system exemplify the manner in which the seven-plant (slack water) system meets a combined load (hourly) with higher reservoir levels and smaller pond fluctuations than would occur with independent operation.

C.2. Shoreline Management

Management of the shorelines of the Columbia River is an important aspect of instream resource protection. The shoreline provides habitat foe wildlife and recreation areas for the enjoyment of the river environment as well as attractive sites for many types of development.

When the Shoreline Management Act was enacted in 1971, the legislature found that the shorelines of the state are a valuable and fragile resource, and as such, demanded a coordinated effort of resource management. The program developed through the Shoreline Management Act (Chapter 90.58 RCW) tempered this need with concern for local control and retention of private property rights.

Washington's shoreline management is a cooperative effort of local and state government in resource management. The state's role through the Department of Ecology (DOE) is one of guidance and overview, while the primary initiative for administration of the program is at the county and/or city level. Guidelines developed by Department of Ecology were utilized in the development of individual county and city "Master Programs" reflecting the uniqueness of each area's shoreline management needs.

Shorelines were defined by the legislature as all shorelines and associated wetlands (generally 200 feet from high water mark) except those upstream of points where flow is 20 cfs less (mean annual) or on lakes less than 20 acres. Some shorelines, however, were given special consideration as shorelines of "statewide significance."

The Columbia and Snake rivers fall into these categories. Local programs were to reflect this special designation by (1) recognizing and protecting statewide interest over local interest, (2) preserving the natural characters of those areas, (3) emphasizing long-term rather than short-term benefits, and (4) increasing the public access and recreation opportunities. Consequently, the county and city master programs for the Columbia and Snake River shorelines should reflect these common considerations.

Each master program contains a basic assessment of the shorelines from the standpoints of (1) present and potential type of shoreline (i.e., urban, natural, etc.), (2) the types of use (activities) allowed in those areas, and (3) mechanisms for conditional use and variance to basic uses.

The Shoreline Act calls for a permit system as the basic mechanism for control of activities within the shoreline areas. Most activities occurring in the shoreline area require a permit. Some exemptions to the permit requirement include construction of single family residences, repair of existing structures, and general construction under $1000.

C.2.a. Existing Conditions

Master programs have been developed by the counties comprising the Columbia River shoreline, except Stevens County which is developing its master program. Appendix L inventories shoreline environment designations by river mile and land marks and summarizes permitted uses in each designation.

C.2.b. Alternatives and Impacts

The alternatives to shoreline management are "no-action" and amend the master programs. To protect instream resources, the shoreline designations and uses should allow public access and restrict intense development and agricultural practices that will destroy wildlife habitat and/or degrade the water quality.

The "no-action" alternative would continue the designations and permitted uses as shown on the tables. In general, the master programs allow agricultural uses in the shoreline areas along the Columbia River with isolated areas of urban development. There would be no new impacts associated with this alternative unless the uses change substantially within the framework of the existing master programs.

If the master programs are amended to allow more intense development, the primary impacts would be to fish, wildlife, and agricultural resources, and the primary benefit would be to economic development. If the amendments are more restrictive, fish and wildlife would be benefited; while agriculture and industrial development would be adversely impacted. These amendments would have to be initiated by the local governments.

In its comment letter, the Washington Environmental Council criticized the inconsistency between shoreline programs. WEC suggested adding the following:

> "If master programs were amended to be more consistent with each other and with Shorelines of Statewide Significance criteria, it would eliminate existing situations in which on one stretch of the undeveloped Columbia grain elevators and docks are permitted outright, while a few yards away across the county line pasture, rangeland and timber harvest are permitted with most other activities set back 100 feet from the river."

This is a difficult alternative to assess. The people of the state voted for a Shoreline Management Act with strong local control. Given this local control it's reasonable to expect differences between local jurisdictions. Actually, differences may be good in that they direct development into some areas and away from others. If the inconsistencies could be eliminated, development could be more spread out.

C.3. Ben Franklin Lock and Dam

The Ben Franklin facility as proposed in 1969 would be a multipurpose dam located in the Columbia River at river mile 348, north of Richland, Washington. One configuration includes a low head dam having a 16-unit powerhouse, a 15-bay spillway, and blanks for a navigation lock. All facilities would be on a straight line across the river. The reservoir would be 40 miles long, cover an area of 24,700 acres, and have a 120-mile shoreline with a normal pool elevation of 400 feet at the dam.

The project would have hydroelectric facilities with a nameplate capacity of 848 megawatts, pool elevation 398, hydraulic capacity of 311,000 cubic feet per second (cfs), and average energy production of approximately 428 megawatts (3.75 billion kilowatt hours per year). If justified, the construction of a navigation lock and slackwater reservoir would bring low-cost transportation of an average 3 million tons of commerce annually to central Washington. Three recreational areas would be provided to meet demands for recreation and sightseeing. Fish ladders on each side of the river would be provided to relieve the impediment for salmon and steelhead migrating upstream to spawn.

C.3.a. Existing Conditions

The dam and reservoir site lies within the 49-mile reach of the Columbia River from Lake Wallula to Priest Rapids Dam. This river reach is in an essentially natural state. Most of the reservoir site would be within the Hanford Reservation. The river flows between high cliffs and bluffs rising from sandy or gravel beaches. The brushlands along the river and the islands give cover to wild animals and fowl. Gravelly streambeds provide spawning areas for Chinook salmon and steelhead.

The following information related to the existing fish and wildlife conditions in the Hanford Reach was primarily provided by the U. S. Fish and Wildlife Service.

The Hanford Reach continues to serve as a migration route for several species of anadromous fish, with an average of about 31,000 chinook, 69,300 sockeye, 4,000 coho salmon, and 7,000 steelhead destined for spawning and rearing areas upstream.

Because the reach retains its free-flowing character and an abundance of gravel bars, riffles, and pools, it also serves as a major spawning area for anadromous fish.

Redd counts through the 1964-1976 period indicate that 20,000-35,000 fall chinook and 8,000 steelhead utilize this area for spawning annually. Natural production from these fish amounts to about 7.89 million and 3.2 million smolts, respectively.

Spawning and rearing facilities at Priest Rapids Dam and Ringold are operated by the Washington Department of Fisheries. Artificial production from these facilities amounts to over 2 million chinook smolts annually. Washington Department of Game also operates rearing facilities for steelhead. The reach also contains important resident fisheries for walleye, yellow perch, smallmouth bass, rainbow trout, brook trout, kokanee, Dolly Varden, and mountain whitefish.

The riparian habitat found along the river shoreline and on islands exhibits high attraction for mule deer during winter and spring months. About 100 deer are found throughout the reach during winter months, and spring production on the islands amounts to about 40-50 fawns annually.

Other land mammals found throughout the reach include coyote, badger, raccoon, skunk, porcupine, beaver, muskrat, mink, black-tailed jackrabbit, cottontail, yellow-bellied marmot, and numerous gophers, shrews, mice, voles, and bats.

Quail, pheasant, and dove are present in substantial numbers throughout the reach but are usually concentrated in areas bounded by riparian vegetation or adjacent to agricultural lands. The sagebrush and open grasslands support chukar and sage grouse. The uncommon sharp-tailed grouse is also thought to inhabit more remote areas adjacent to the reach.

The Hanford Reach provides suitable habitat for most species of waterfowl represented in the Pacific Flyway. Aerial census surveys conducted over the past several pears indicates a high value and incidence of use during winter months. Wintering duck populations average 30,000-50,000 birds annually with peaks occasionally exceeding 100,000. Canada geese use averages about 6,000 birds annually with peaks occasionally exceeding 20,000. Spring and summer goose production is substantial with an average of 250 pairs nesting on preferred islands and producing about 740 young annually. Another 125-130 geese use the area as nonbreeders. Suitable nesting habitat for duck production is generally limited to narrow bands of riparian and/or marshy habitat along the river shoreline, sloughs, and small embayments. Nesting is primarily by teal, mallard, coot, gadwall and merganser.

Stands of poplar, willow, and cottonwood on islands and nearshore areas provide roasting and nesting for at least 20 pairs of black-crowned night herons and 40-100 pair of great blue heron. Islands provide resting and nesting habitat for ring-billed and California gull colonies numbering over 3,500 individuals and another 25 pair of Forster's Tern. Also found in substantial numbers are avocets, yellowlegs, sandpipers, and long-billed curlews.

The Hanford Reach supports the most diverse raptor populations of any stretch of the mainstem Columbia. Of the total 21 species known to exist, at least 10 nest in the area, including prairie falcon, red-tailed hawks, great horned owls, and kestrel. Long-eared owls and marsh hawks are locally common near wetlands and riparian zones, and an unusually large number of Swainson's hawks nest in areas adjacent to the river throughout the reach. There have been at least two sightings of peregrine falcons in the area; however, it is unknown whether these are resident or migratory birds. Wintering activity of bald eagles is substantial with an average of 4-6 adults and 2-4 juveniles observed during winter months. Peak bald eagle activity in recent years has been as high as 15 birds.

Of the species identified above, only two are nationally listed as threatened or endangered; the peregrine falcon is currently endangered and the bald eagle is threatened. Others which are of special concern, or undergoing serious decline in population are 21 species of birds including the prairie falcon and 10 other raptors; the long-billed curlew; Forster's Tern; black-crowned night heron; golden eagle; and Osprey. Other uncommon species include the Ord's kangaroo rat, 8 species of amphibians and reptiles including Woodhouse's toad and the desert night snake, and 21 of the 43 species of fish including the sandroller and white sturgeon.

The alternatives to construction of the Ben Franklin facility are (1) not to build ("no-action"), and (2) further study.

The "no-action" alternative would mean the reach would continue to be free-flowing and the impacts associated with construction of the dam would not be realized. There is currently recreational demand for this last unimpounded reach of the river.

The alternative to conduct further study of the dam and potential impacts is currently being followed by the U.S. Army Corps of Engineers. They are funded for and currently working on a four-year study. The results of the study and the recommendations of the Corps of Engineers are due in the fall of 1982. The U.S. Department of Interior formally opposes construction of the Ben Franklin Lock and Dam.

The impacts associated with construction of the dam are noted below for the elements of the environment that are significantly affected.

Anadromous Fish. Nearly all of the existing natural spawning area now occurring in the Hanford Reach for chinook salmon and steelhead would be lost with reservoir inundation, including much of the habitat of resident fish species currently found in the area. Fish rearing facilities at Ringold would be inundated and require replacement (if possible). At least 10 percent of the salmon and steelhead destined upstream would be lost due to increased stresses of passing over and through another dam and reservoir. Another 15 percent of downstream migrants would be lost to turbine mortality under no spill conditions. Additional losses are expected to occur from increased nitrogen supersaturation downstream from the dam. The delayed flushing rate and increased temperature effects could inhibit fish migration and the extended delays could increase pre-spawning mortality by up to 75 percent. Warmer water temperature will also encourage undesirable fish production and fish disease. Any impacts to anadromous fish will, of course, cause concomitant economic, social, and cultural impacts to those people in the Pacific Northwest who depend on these fish for commercial or sports reasons.

Wildlife and Resident Fish. Inundation of terrestrial habitats will have serious effects on wildlife species. The new reservoir will eliminate up to 80 percent of existing islands used for nesting by geese and shorebirds, loafing by wintering waterfowl, and as fawning areas by mule deer.

Most of the riparian vegetation on the reach would be flooded out or lost to fluctuating water levels above and below the dam resulting in serious losses to upland game birds, deer, beaver, mink, raccoon, raptors, songbirds, and small mammals. Spills and fluctuating water levels downstream of the proposed dam site would affect ring-billed and California gulls, and Forster's tern colonies, flooding nesting sites and probably encouraging colony desertion of the areas involved.

Reservoir levels would flood out and destroy perching trees utilized by raptors, in particular the bald eagle, resulting in the reduction of wintering use by this species.

Increased public use of the new reservoir would require the development of 1,315 acres of campgrounds, picnic areas, and boat launching facilities to accommodate recreational needs. Construction of these facilities would result in the secondary loss of an equal number of acres of habitat base further imparting dependent wildlife. These facilities would encourage the presence of larger numbers of people increasing the probability of harassment to wildlife sensitive to human activity and noise.

The new dam will require the addition of power conveyance facilities such as transformer stations and powerlines resulting in further loss of terrestrial habitat and increasing the probability of bird strikes and electrocution of large raptor species. Hunting currently expended along the reach will be lost through inundation of habitat, reductions in game animals populations and access. Resident game fish habitat would be changed from a stream to a reservoir habitat.

Nuclear Facilities and Stored Wastes. Investigations were made evaluating the effects of raised ground water table from the proposed reservoir on the Hanford Reservation's operations area structures and on buried and other waste disposal facilities. It was concluded that no adverse or untenable effects would result from maintaining the reservoir at elevation 400 feet. However, there will be some removal of critical buried wastes, monitoring of foundation settlement, and protection of some reactor galleries and liquid waste disposal basins.

Expected leaching of contaminants under extreme conditions indicate concentrations of isotopes in the river to be several orders of magnitude below permissible drinking water limits.

Water Quality. The horizontal stratification of river temperatures may be increased in the area of reactor cooling water outfalls. Ben Franklin Reservoir would be a run-of-the-river reservoir and impoundment would probably increase the water temperature a maximum of 0.5° to 1°F during the late summer by reducing the river velocity. It may also cause a delay of about four days in the occurrence of the peak temperature.

Historical and Archaeological Sites. There may be one early military settlement with at least one cabin dating back to 1855. There are several old Indian campsites and burial grounds within the proposed reservoir site.

In a study conducted by the Mid-Columbia Archaeological Society, 105 archaeological sites were recorded and evaluated. Of these, 49 have been recommended for test excavation or full-scale excavation. Each of these sites were riparian and within the area that would be inundated by the dam as proposed in 1969. According to the report by Dr. David G. Rice, entitled Archaeological Reconnaissance - Ben Franklin Reservoir Area, 1968, "these sites are of crucial importance in linking together archaeological research in contiguous areas . . ." [and] ". . . will be invaluable for establishing a local cultural sequence for the Middle Columbia Region."

In February 1979, the U.S. Department of Interior listed six Hanford sites in its "Listing of Historical Properties."

If the project is constructed, shoreline erosion would likely occur as a result of waves and pool fluctuation. Archaeological sites could be damaged as could certain geological formations such as the White Bluffs which are important geologically as the type locality of the Ringold formation and relate directly to the problem of the Pliocene-Pleistocene boundary.

Hydroelectric Power. The March 1979 Pacific Northwest Utilities Conference Committee forecasts indicate total energy deficits for each year through 1989-1990, averaging approximately 1,800 megawatts during this 11-year period. Considering a two-year delay of construction of thermal plants, the deficit would increase to some extent. The construction of Ben Franklin Dam would include 16 power-generating bays. Each generating unit would consist of a turbine with a nameplate rating of 53,000 kilowatts. The nameplate rating is the rating given by the manufacturer at which equipment can operate continuously. Specifications require a continuous operation at greater than nameplate rating, however. It would have a dependable capacity of approximately 938 megawatts (10 percent over nameplate). This capacity would be capable of producing approximately 3.75 billion kilowatt hours of energy annually (428 MW average energy). This would help to relieve the estimated firm deficit.

Navigation. Construction of a navigation lock or blanks and, therefore, the possibility of a slack-water reservoir could bring low cost transportation to the central Washington area. Approximately 3 million tons of commerce annually may be expected to move through such a lock. Barge traffic is expected to be roughly 18 million tons annually by the year 2000. Expansion of Columbia River navigation could have a negative impact on truck and rail transportation and on Puget Sound ports.

Recreation. Current restrictions by the Department of Energy limit recreation opportunities in this area. Additional recreation opportunities would be provided within the bounds of Department of Energy limitations. To the extent that steelhead and salmon are not replaced or enhanced, sports fishing would be reduced; to the extent such runs would be enhanced, sports fishing may be enhanced. The project would eliminate the last 49 miles of unimpounded Columbia River recreation above Bonneville Dam within the state. It would provide a 12th reservoir for slackwater recreation.

C.3.b. Alternatives and Impacts

The alternatives to construction on the Ben Franklin facility are (1) not to build ("no-action"), and (2) further study.

The "no-action" alternative would mean the reach would continue to be freeflowing and the impacts associated with construction of the dam would not be realized. The economic value of the existing fish and wildlife resources would remain unimpaired.

The alternative to conduct further study of the dam and potential impacts is currently being followed by the U.S. Army Corps of Engineers. They are funded for and currently working on the first year of a four-year study. The results of the full study and the recommendations of the Corps of Engineers are due in the fall of 1982.

C.4. Designation of Hanford Reach as a Wild and Scenic River

The Hanford Reach is the last "free-flowing" part of the Columbia River in the U.S. that is not affected by tidal action. This 49-mile reach is located between the backwater of the McNary Pool (Lake Wallula) and Priest Rapids Dam.

C.4.a. Existing Conditions

The Hanford reach of the Columbia River was listed as a potential national wild, scenic and recreational river by the Secretary of Agriculture and the Secretary of the Interior is accordance with Section 5(d) of the Wild and Scenic Rivers Act (P.L. 90-542, October 2, 1968).

Section 5(d) states:

> "In all planning for use and development of water and related land resources, consideration shall be given by all federal agencies involved to potential national wild, scenic and recreational river areas and all river basin and project plan reports submitted to the Congress shall consider and discuss any such potentials."

In addition, President Carter in his 1977 environmental message, recommended that the main stem of the Columbia from Priest Rapids Dam to McNary reservoir be designated for study [listed under section 5(a)] as a potential component of the National Wild and Scenic Rivers System. Congress would have to pass an amendment to the Scenic Rivers Act to place the river in study status.

If the river were elevated to study status, no federal agency could initiate construction of a project or issue a license (FERC license) for a project on the study segment. There usually is a time frame imposed to complete the study. The prohibition on construction and licensing would continue only if Congress added the river to the system.

C.4.b. Alternatives and Impacts

The alternatives available under this option are only available to the Congress and include "no action" and placing the river in study status. The "no action" alternative continues the existing requirement for any federal agency to consider the wild, scenic, and recreational river values. The alternative to place the river in study status would preclude any construction that would impede the free-flowing river.

The impacts associated with changing the river to study status are numerous. The adverse impacts center on energy and navigation as dam and lock construction would not be allowed while the river is being studied. The beneficial impacts center on fish, wildlife and recreation which are dependent on a free-flowing river. The river characteristics would be protected during the study period. These would be short-term impacts unless Congress chose to include the river in the Wild and Scenic River System at the end of the study.

V. ALTERNATIVES AND IMPACTS

The "alternatives" to the proposed action need to be viewed in several different ways. Table 1 in the Program Document established the goal of the program as maintenance and enhancement of environmental quality as well as economic and social well-being. Within the context of the program, fish and wildlife, recreation, the natural and cultural environment, and navigation are seen as the main areas in which this goal can be achieved. The management options which are available are shown in the Table.

These management options have been discussed in the previous section. Alternative courses of action have been discussed and analyzed. Almost any permutation of them could be used. The object, however, is to select combinations of measures which will act together to have the desired effect.

Table 21 details the seven Alternative Management programs considered. Alternatives A, B, and F were generated by DOE. Alternative F is the proposed action. Alternative C and G were suggested by the various fish and wildlife agencies. The Bureau of Indian Affairs also suggested Alternative G. Alternative D was suggested by the Washington Environmental Council. Alternative E is the "no action" alternative and was supported by several user groups. A summary of the alternatives is shown in Table 14 in the Program Document.

Alternative A (DOE) provides almost the same minimum flow levels as the proposal with a maximum 100 percent cutback on future rights instead of 50 percent as proposed. In low water years, the impacts to agriculture would be more severe because of higher (up to 100 percent) cutbacks. The benefits to fish and wildlife would be higher because this alternative does not have a provision for reduction in the minimum flow levels. The impacts on power are slightly higher in this alternative because the water saved from the larger cutback is less than that required to maintain the higher minimum flow levels.

The provisions for spill are also different for Alternative A. This alternative would seek spill provisions through federal authorizations and/or FERC licenses in addition to providing a volume of water through reallocation and additional storage. The benefits of spill are strictly for the passage of downstream migrant fish. The adverse impacts of specific spill requirements can be substantial on power production because of the constraints on operational flexibility.

The support for the construction of the Bumping Lake Enlargement Project will have little affect on the instream resource protection program. It does have fish and wildlife enhancement as one of the authorized purposes. However, the flow from that project enters the Columbia through the Yakima River which is below the critical flow areas.

Alternative B (DOE) provides a lower level of protection of instream resources than the proposed program. The flow provision is for average daily flows from May through June 15 only. This provides velocity through the reservoirs for the passage of downstream migrant salmon. The impacts to power production are limited because of the short period that the minimum flows are required. Alternative B has no instantaneous flow requirements and, therefore, has no corresponding power impact.

Table 21
ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative A

I. Provision/Maintenance of Instream Flows

State would seek through the means identified below maintenance of the following minimum average daily flows.

(See 12/78 CRFC Recommendations.)

State would seek through the means identified below maintenance of an interim minimum instantaneous flow of 50,000 cfs except where specific FERC license requirements exist pending further study.

1. Conservation and Efficiency Provision

State would adopt an administrative regulation providing for a conservation and efficiency provision to be attached to future water rights. The extent of diversion cutback would be tied to forecasted runoff as measured at Grand Coulee and The Dalles. Specific relationships would be as according to Alternative 8 discussed in the EIS. The remainder of the Columbia Basin Project would be included.

2. USBR Water Rights

State would negotiate with USBR for a change in its 1938 storage right for Grand Coulee to reallocate 2.0 million acre-feet for fish, wildlife, and other stream resources.

3. Federal Project Authorization/Reauthorization

a. State would condition support of federal authorization of additional hydro units on the provision of adequate fish passage.

b. State would pursue authorization of the mainstem Columbia River dams operated by USBR and COE. This would be to make fish, wildlife, and other instream uses authorized project purposes, and thereby permit operation of the projects to provide minimum flows and spill and control pool fluctuation.

c. State would cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish, wildlife, and other instream uses as authorized purposes.

4. FERC Licensing

State would pursue, through FERC amendments to the licenses for the five PUD projects on the Columbia, protection for fish, wildlife, and other instream uses.

5. Additional Storage

a. State would support construction of the Bumping Lake Enlargement Project.

b. State would support further study of additional storage on the Similkameen River.

II. Provision of Spill at Columbia River Dams Passage of Juvenile Fish

State would seek through the means identified below provision of the following spill for ,juvenile fish passage.

(See 12/78 CRFC Recommendations.)

See I; 3; 4.a., b., & c.; 6.b. above.

III. Control of Reservoir Pool Fluctuation

State would seek through the means identified below specified limits on reservoir pool fluctuation; such limits would be developed on the basis of the results of the Department of Game's current study.

See I.4. and I.5. above.

IV. Other

1. Ben Franklin Dam

State would support Corps of Engineers' study of Ben Franklin reach.

2. Water Quality Management

State would continue existing program.

3. Shoreline Management

State would continue existing program.

Table 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative B

I. Provision/Maintenance of Instream Flows

State would seek through the means identified below maintenance of the following minimum average daily flows.

River Reach	Flow	Time Period
Wells Pool through Hanford Reach	100,000 cfs	May 1 to
McNary and John Day Pools	200,000 cfs	June 15
The Dalles and Bonneville Pools	145,000 cfs	(approx.)

(Source: COFO 1979 Plan of Action)

State would support further study of minimum instantaneous flow requirements.

1. Conservation and Efficiency Provision

State would adopt an administrative regulation providing for a conservation and efficiency provision to be attached to future water rights. The extent of diversion cutback would be tied to forecasted runoff as measured at Grand Coulee and The Dalles. Specific relationships would be as according to Alternative C discussed in the EIS. The remainder of the Columbia Basin Project would be excluded.

2. USBR Water Rights

State would negotiate with USBR for a change in its 1938 storage right for Grand Coulee to reallocate 1.4 million acre-feet for fish, wildlife, and other instream resources.

3. Federal Project Authorization/Reauthorization

a. State would condition support of federal authorization of additional hydro units on the provision of adequate fish passage.

b. – – – –

c. State would cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish, wildlife, end other instream uses as authorized purposes.

Alternative B (Continued)

4. FERC Licensing

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5. Additional Storage

a. State would support construction of the Bumping Lake Enlargement Project.

II. Provision of Spill at Columbia River Dams for Passage of Juvenile Fish

State would seek through the means identified below provision of the following spill for juvenile fish passage.

Wells, Rocky Reach, Rock Island, Wampum, Priest Rapids	- 200,000 a.f
McNary, John Day .	- 300,000 a.f.
The Dalles, Bonneville	- No special spill

(Sources COFO 1979 Plan of Action)

See I.1; 3; 4.b. & c.; 6.b. above.

III. Control of Reservoir Pool Fluctuation

State would seek through the means identified below specified limits on reservoir pool fluctuation; such limits would be developed on the basis of the results of the Department of Game's current study.

See I.4. and I.5. above.

IV. Other

1. Ben Franklin Dam

State would support Corps of Engineers' study of Ben Franklin Dam.

2. Water Quality Management

State would continue existing program.

3. Shoreline Management

State would continue existing program.

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative C

I. Provision/Maintenance of Instream Flows

State would seek through the means identified below maintenance of the following minimum average daily flows.

(See 12/78 CRFC Recommendations.)

State would seek through the means identified below maintenance of the following minimum instantaneous flows. (Also see below)

(See 12/78 CRFC Recommendations.)

1. Conservation and Efficiency Provision

State would adopt an administrative regulation providing for a conservation and efficiency provision to be attached to future water rights. The extent of diversion cutback would be tied to forecasted runoff as measured at Grand Coulee and The Dalles. The goal of this regulation would be to provide flow conditions as described above. Specific relationships would be as according to Alternative C discussed in the EIS. The remainder of the Columbia Basin Project would be included.

2. USBR Water Rights

State would negotiate with USBR for a change in its 1938 storage right for Grand Coulee to reallocate 2.0 million acre-feet for fish, wildlife and other instream resources.

3. Federal Project Authorization/Reauthorization

a. State would condition support of federal authorization of additional hydro units on the provision of adequate fish passage and fish and wildlife compensation and mitigation.

b. State would pursue reauthorization of the mainstem Columbia River dams operated by USBR and COE. This would be to make fish, wildlife and other instream uses authorized project purposes, and thereby permit operation of the projects to provide minimum flows and spill and control pool fluctuation.

c. State would cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish, wildlife, and other instream uses as authorized purposes.

Alternative C (Continued)

4. FERC Licensing

State would pursue through FERC amendments to the licenses for the five PUD projects on the Columbia to provide protection for fish, wildlife, and other instream uses.

5. Additional Storage

a. State would support construction of the Bumping Lake Enlargement Project with guaranteed instream flow rights for fish.

b. State would support removal of Enloe Dam on the Simikameen River with laddering as a less-preferred alternative.

c. State would support study of additional storage projects that will provide guaranteed instream flow rights for fish without adverse impacts to spawning areas, wildlife, or endangered species:

II. Provision of Spill at Columbia River Dams for Passage of Juvenile Fish

State would seek through the means identified below provision of the following spill for juvenile fish passage.

(See 12/78 CRFC Recommendations.)

See I; 3; 4.b. & c.; 6.b. above.

III. Control of Reservoir Pool Fluctuation

State would seek through the means identified below specified limits on reservoir pool fluctuation; such limits would be developed on the basis of the results of the Dept. of Game's current study.

See I.4. and I.5. above.

IV. Other

1. Ben Franklin Dam

State would support preservation of the free-flowing Hanford Reach in lieu of study and/or construction of the Ben Franklin dam.

2. Water Quality Management

State would continue existing program.

3. Shoreline Management

State would continue existing program.

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative D

I. Provision/Maintenance of Instream Flows

State would seek through the means identified below maintenance of the following minimum average flows: (See CRFC Recommendations and WEC modification.) See figure as modified.)

State would seek through the means identified below maintenance of an interim minimum instantaneous flow of 70,000 cfs and will seek a change in any FERC license at time of renewal which does not allow for such a flow.

1. Conservation and Efficiency Provision

State would adopt an administrative regulation providing for a conservation and efficiency provision to be attached to future water rights. The extent of diversion cutback would be tied to forecasted runoff as measured at Grand Coulee and The Dalles. The remainder of the Columbia Basin Project would be included.

2. USBR Water Rights

State would negotiate with USBR for a change in its 1938 storage right for Grand Coulee to reallocate 3.0 million acre-feet for fish and other instream resource users:

3. Federal Project Authorization/Reauthorization

a. State will condition support of federal authorization of additional hydro units on the provision of adequate fish passage.

b. State will pursue authorization of the mainstem Columbia River dams operated by USBR and COE to include fish and wildlife instream needs as an authorized project purpose.

c. State will cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish and wildlife instream needs as an authorized project purpose.

Alternative D (Continued)

d. State will actively seek Congressional appropriations for mitigation of all federal dams on the Columbia River end its tributaries.

4. FERC Licensing

State will pursue through FERC amendments to the licenses for the five mainstem Columbia Dams to set minimum flows or to assure safe passage of migrating juveniles of salmon end steelhead.

5. Additional Storage/Reallocation of Storage

State will support additional water storage reallocation of water storage only if flows are provided for fish.

II. Provision of Spill at Columbia River Dams for Passage of Juvenile Fish

1. State will seek through water right provisions, negotiation, federal project reauthorization, FERC relicensing, and any other appropriate means, provisions of the following spill for juvenile fish passage. (See CRFC Recommendation)

2. State will support installation and use of the following devices for fish passage of juveniles:

- fish ladders
- fish attraction devives
- sequential turbine shutdown
- fish screens
- flip lips
- fish transport (this method to be considered a supportive measure until adequate fish passage facilities are installed at all mainstem dams)

III. Control of Reservoir Pool Fluctuation

State will adopt a policy establishing specified limits on reservoir pool fluctuations; such limits to be developed based on data from the current WDG study and any other pertinent data.

IV. Water Quality Management

State will support a policy of water quality improvement for fish/wildlife/ recreational uses.

Alternative D (Continued)

V. Artificial Production

State will support programs of other state, federal, public, and private hatcheries, and will actively assist these groups in the appropriation of necessary funding.

VI. Natural Production

State will establish a policy for the enhancement and preservation of existing natural spawning areas on the Columbia River and its tributaries.

VII. Wildlife

1. Provision/Maintenance of Instream Flows

   a. Minimum Daily Average Flow. (See Anadromous Fish above.)

   b. Minimum Instantaneous Flow. (See Anadromous Fish above.)

   c. Conservation Cutback Provision. (See Anadromous Fish above.)

2. Pool Fluctuation

   State will adopt a policy establishing specified limits on reservoir pool fluctuations; such limits to be developed based on data from the current WDG study and any other pertinent information. Special consideration will be given those areas of known nesting avian and mammalian species.

3. Water Quality Management. (See Anadromous Fish above.)

VIII. Recreation

1. Pool Fluctuation

   See above. Emphasis to be placed on hazards and danger to human beings from the rapid rise and fall of water level.

2. Fisheries Enhancement

   Include all of Section I - VI.

3. Wildlife Enhancement

   Include all of Section VII.

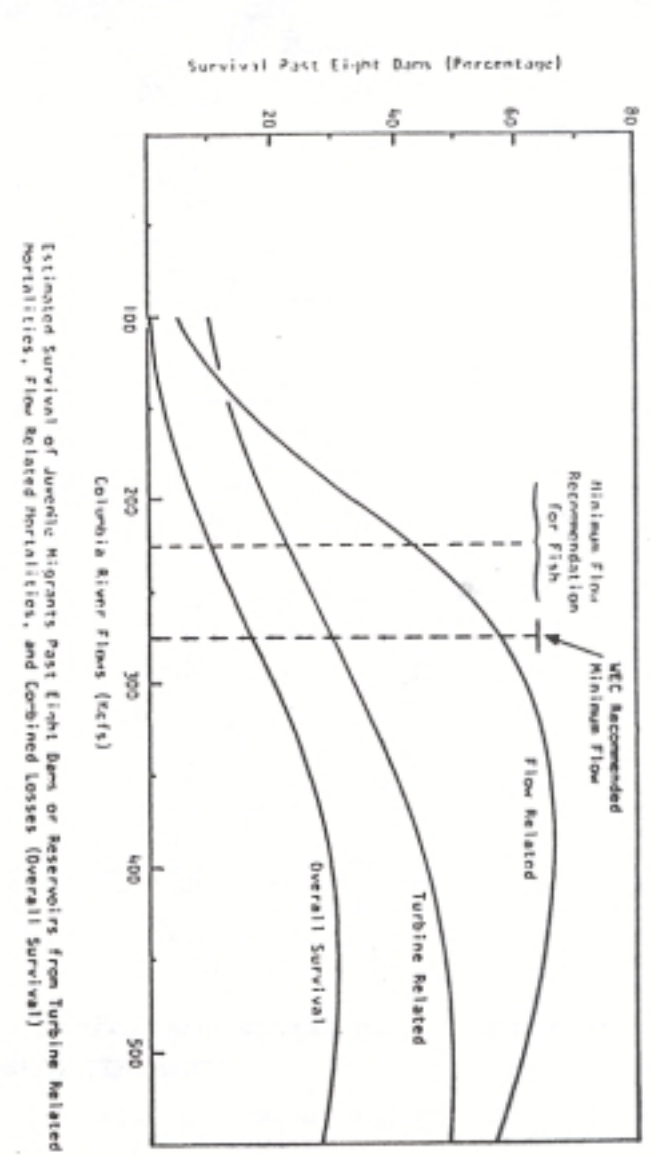

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative E (Existing Situation)

I. Provision/Maintenance of Instream Flows

The department would support maintenance of the following minimum average daily flows as established by FPC (FERC) license or operating practice:

Grand Coulee-Priest Rapids Dams	36,000 cfs
Lower Granite-Ice Harbor Dams	5,000 cfs
McNary-Bonneville Dams	50,000 cfs

The department would support maintenance of the following minimum instantaneous flows as established by FPC (FERC) license or operating procedures ,

Grand Coulee-Priest Rapids Dams	36,000 cfs
Lower Granite-Ice Harbor Dams	5,000 cfs
McNary-Bonneville Dams	50,000 cfs

Irrigation Water Rights

The department would continue to issue irrigation water rights under the normal application, permit, end certificate process.

Federal Project Authorization/Reauthorization

The department would represent the state's interest in federal authorization/ reauthorization actions.

FERC Licensing

The department would represent the state's interest in FERC licensing proceedings.

Additional Storage

The department would support further study of additional storage on the Similkaneen River as the most apparent cost-effective means of supplying up to 600,000 acre-feet of assured flow augmentation from a "new" source in this state.

Ben Franklin Dam

The department would support the Corps of Engineers' Ben Franklin study.

Alternative E (Continued)

Water Quality Management

The department would continue its existing program.

Shoreline Management

The department would continue its existing program.

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative F

I. Provision/Maintenance of Instream Flows

Department would seek, through the means identified below, maintenance of the following minimum average daily flows with modification during low flow years.

(See 12/78 CRFC Recommendations and discussion of recommended flow reduction in low water years.)

Department would seek, through the means identified below, maintenance of an interim minimum instantaneous flow of 50,000 cfs except for a flow of 36,000 cfs at and above Priest Rapids Dam from September 1 – October 15. This flow is subject to the same modification during low flow years as the minimum average daily flow, but in no case shall fall below 36,000 cfs at and above Priest Rapids Dam.

1. Conservation and Efficiency Provision

Department would adopt an administrative regulation providing for a conservation and efficiency provision to be attached to future water rights. The extent of diversion cutback in low water years would be tied to forecasted runoff as measured at The Dalles. Specific relationships are discussed in the Recommended Program section of this document. The remainder of the Columbia Basin project would be excluded.

2. The Department would seek, through negotiations with various interests, and the creation of additional storage, an assured volume of 2.0 MAF of water for fish and wildlife purposes to be available at, and downstream of, Wells Dam.

3. Federal Project Authorization/Reauthorization

a. Department will seek appropriate authorization language for the purpose of establishing an authorization inclusive of fish and wildlife purposes for the McNary Second Powerhouse and Chief Joseph projects.

b. Department would cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish, wildlife, and other instream uses or authorized purposes.

Alternative F (Continued)

c. Department would support inclusion of language in project authorization and re-authorizations that would establish an authorization inclusive of fish and wildlife. The department reserves the right to reconsider its support where specific project operation criteria are being proposed.

4. FERC Licensing

Department will support the intervention by the Washington Departments of Fisheries and Game in the FERC license proceedings for the mid-Columbia PUD dams for the purposes of providing protection for fish, wildlife, and other instream uses. However, this support would be conditioned on the establishment of provisions for the reduction of the quantity of water provided for fish, wildlife, and other instream resources during low water years and is limited to the interim instantaneous flows recommended above. This program provides no specific requirement for spill.

The department is an intervenor in the FERC intervention activities of the WDF and WDG. The primary aim of this action by DOE is to promote the idea of modification of the recommended minimum instantaneous and daily average flows during low water years to assure a sharing of the shortage and a balanced use of the resource.

5. Additional Storage

The department supports environmentally and economically sound additional storage on the Columbia River system. In supporting further study of additional storage, the Similkameen River appears to offer the greatest potential for supply up to 600,000 a.f. of assured flow augmentation from a "new" source in this state.

Governor Ray and the Yakima Indian Nation recently announced the "Yakima River Basin Water Enhancement Project" which is designed to resolve water use conflict in the Yakima River system through provision of up to 1,022,100 acre-feet of storage.

II. Provision at Columbia River Dams for Passage

Department would not seek specific spill provisions, but would seek to attain an assured volume of water dedicated to fish and wildlife purposes. Use of said waters is to be determined by the system operators and the fish and wildlife interests. Intensive management of the system is specifically recommended.

III. Control of Pool Fluctuation

Department will consider specific recommendations regarding reservoir fluctuation limits when information becomes available.

IV. Other

1. Water Quality Management

Department would continue its existing program.

2. Shoreline Management

State would continue its existing program.

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative G

I. Provision/Maintenance of Instream Flows

State would seek through the means identified below, maintenance of the following minimum average daily flows.

CRFC Optimum Flows

State would seek through the means identified below, maintenance of the following minimum instantaneous flows:

CRFC recommendations with modification below Bonneville.

State would seek through the means identified below, maintenance of the following wildlife protection flows:

Washington Department of Game recommendations.

1. Conservation and Efficiency Provision

Forecast at Grand Coulee and the Dalles. Alt. A - 50 percent cutback at 60 MAF forecast. Remainder of Columbia Basin Project and application under John Day/McNary reservation included.

2. Reallocation of Storage

Reallocate 3.0 MAF from Grand Coulee and above. Study potential reallocation from other project reservoirs.

3. Federal Project Reauthorization

State would support provision of fish passage, habitat restoration, and fish and wildlife compensation. State would pursue reauthorization of all existing Columbia Basin projects to make fish and wildlife authorized project functions.

4. FERC Licensing

State would seek protection of instream resources through FERC license proceedings, to provide optimum flow, spill and pool fluctuations specified above.

Alternative G (Continued)

5. Additional Storage

Support Bumping Lake with guaranteed water for fish. Removal of Enloe Dam or laddering. Support study of environmentally sound storage projects to provide guaranteed optimum flows for fish and wildlife.

II. Provision of Spill at Columbia River Dams for Passage of Juvenile Fish

CRFC recommendations.

III. Control of Pool Fluctuation

Seek specified limits based on WDG study. Control fluctuations to eliminate recreational conflicts and enhance safety.

IV. Other

1. Ben Franklin Dam

Oppose USCE study. Preservation of Hanford Reach.

2. Water Quality Management

Increase efforts to bring water quality into compliance with Class A standards below Grand Coulee and Class AA above.

3. Shoreline Management

State will encourage updating of shoreline plans to bring them into line with designation as shorelines of statewide significance, with special emphasis on preservation of fish and wildlife habitat.

4. Artificial Production

State will support efforts to receive past due compensation for present dams.

5. Natural Production

Preserve, restore, and enhance natural spawning areas.

6. Wildlife

Preserve, restore, and enhance wildlife habitat.

TABLE 21 (Continued)

ALTERNATIVE MANAGEMENT PROGRAMS

Columbia River Instream Resource Protection Program

Alternative H (Recommended Program)

I. Provision/Maintenance of Instream Flows

Department would seek, through the means identified below, maintenance of the following minimum average daily flows with modification during low flow years.

(See 12/78 CRFC Recommendations and discussion of recommended flow reduction in low water years.)

Department would seek, through the means identified below, maintenance of an interim minimum instantaneous flow of 50,000 cfs except for a flow of 36,000 cfs at and above Priest Rapids Dam from September 1 – October 15. This flow is subject to the same modification during low flow years as the minimum average daily flow, but in no case shall fall below 36,000 cfs at and above Priest Rapids Dam.

1. Conservation and Efficiency Provision

Department would adopt an administrative regulation providing for the establishment of conservation and efficiency fundamentals to guide the department in its water resource management activities. The implementation of this provision would help foster efficient use of the resource and in sharing the burden of low water years.

2. The Department would seek, through negotiations with various interests, and the creation of additional storage, an assured volume of 2.0 MAF of water for fish and wildlife purposes to be available at, and downstream of, Wells Dam.

3. Federal Project Authorization/Reauthorization

a. Department will seek appropriate authorization language for the purpose of establishing an authorization inclusive of fish and wildlife purposes for the McNary Second Powerhouse and Chief Joseph projects.

b. Department would cooperate with and support any efforts of the State of Idaho directed toward reauthorization of the Dworshak Dam project to include fish, wildlife, and other instream uses or authorized purposes.

c. Department would support inclusion of language in project authorization and re-authorizations that would establish an authorization inclusive of fish and wildlife. The department reserves the right to reconsider its support where specific project operation criteria are being proposed.

Alternative H (Continued)

4. FERC Licensing

Department will support the intervention by the Washington Departments of Fisheries and Game in the FERC license proceedings for the mid-Columbia PUD dams for the purposes of providing protection for fish, wildlife, and other instream uses. However, this support would be conditioned on the establishment of provisions for the reduction of the quantity of water provided for fish, wildlife, end other instream resources during low water years and is limited to the interim instantaneous flows recommended above. This program provides no specific requirement for spill.

The department is an intervenor in the FERC intervention activities of the WDF end WDG. The primary aim of this action by DOE is to promote the idea of modification of the recommended minimum instantaneous and daily average flows during low water years to assure a sharing of the shortage and a balanced use of the resource.

5. Additional Storage

The department supports environmentally and economically sound additional storage on the Columbia River system. In supporting further study of additional storage, the Similkameen River appears to offer the greatest potential for supply up to 600,000 a.f. of assured flow augmentation from a "new" source in this state.

Governor Ray end the Yakima Indian Nation recently announced the "Yakima River Basin Water Enhancement Project" which is designed to resolve water use conflict in the Yakima River system through provision of up to 1,022,100 acre-feet of storage.

II. Provision of Spill at Columbia River Dams for Passage Juvenile Fish

Department would not seek specific spill provisions, but would seek to attain an assured volume of water dedicated to fish and wildlife purposes. Use of said waters is to be determined by the system operators and the fish and wildlife interests. Intensive management of the system is specifically recommended.

III. Control of Pool Fluctuation

Department will consider specific recommendations regarding reservoir fluctuation limits when information becomes available.

IV. Other

1. Water Quality Management

Department would continue its existing program.

2. Shoreline Management

State would continue its existing program.

The conservation and efficiency provision for Alternative B is the least restrictive to irrigated agriculture. The benefits to fisheries and power production are also less.

The volume of water to be negotiated for instream resource protection is 0.6 million acre-feet less because Alternative B excludes support for storage an the Similkameen River. Therefore, a lower volume of water would be available for instream resource protection. Adverse impacts associated with possible construction of additional storage on the Similkameen would not be incurred.

The spill provision in Alternative B are for specific amounts. These amounts may be less than what would be available through the proposed program. If so, the impacts to power production would be less and the benefits to fish passage would also be less.

Alternative C (Fish and Wildlife Agencies) provides a slightly higher level of instream resource protection than the proposed program. The major differences are: 1) the levels of minimum instantaneous flows to be maintained; and 2) support for study of additional storage projects (however, not on the Similkameen).

The major additional impacts of Alternative C are to the power industry because the minimum instantaneous flows are generally higher is the summer (when the availability of water and power demand are lower) and lower in the winter (when the availability of water and power demand are higher).

Alternative D (Washington Environmental Council) provides a high level of instream resource protection. This alternative includes higher minimum levels of average daily flows and instantaneous flows than Alternatives A, B, or C. The alternative also 1) includes minimum instream flow provisions for all discharge permits on the Columbia River, 2) negotiation for 3.0 million acre-feet at Grand Coulee, and 3) the same spill requirements as alternative A. These elements all benefit fish and wildlife and have adverse impacts on power production.

This alternative also incorporates some provisions strictly for the benefit of anadromous fish. These are to 1) seek Congressional appropriation for mitigation of losses due to federal dams, 2) provide support for installation of structural measures for fish, 3) provide support for hatchery programs, and 4) establish a policy for the enhancement and preservation of spawning areas.

Alternative E is the "no-action" alternative. There are no new adverse impacts or benefits associated with this alternative.

Alternative H is the proposed program. The impacts of this alternative are discussed in section III of the Environmental Impact Statement and section V.B of the Program Document.

Alternative G (National Marine Fisheries Service -- essentially the same as the recommendation of the U.S. Fish and Wildlife Service and the Bureau of Indian Affairs) provides essentially that the Columbia River be operated for the benefit and enhancement of the fisheries resources with other uses assuming a secondary role.

The use of "optimum flow levels" (shown in Table 16 of the Program Document) would adversely affect irrigation and power production flexibility. The NMFS letter which suggests this alternative states:

> We are in general agreement with the concept of providing a minimum level of flows for anadromous fish with provisions for "sharing the shortages" in water deficient years. However, the critical aspect of such a procedure is the selection of the baseline level. In your presentation you have used as the baseline the minimum flow recommendations of the Columbia River Fisheries Council. A more appropriate baseline would be the optimum flows required for anadromous fish, with a recognition that in a low flow year (such as 1977) there would be a "sharing of the shortage" and a reduction in the flows available for anadromous fish. It is our understanding that the Columbia River Fisheries Council is in the process of defining optimum flow levels as a part of its on-going planning effort. We feel strongly that these should be used as your baseline flows.
>
> If you proceed with the use of the Columbia River Fisheries Council's minimum flow recommendation as your baseline, then it is our strong view that there should be a "sharing of the abundance," and that in other than extremely low flow years, additional flows should be provided for anadromous fish needs. We urge that you give consideration to a procedure of this type.

The "sharing of the abundance" concept is interesting. It could result in some exceptionally good years for habitat conditions related to flow. However, it would require administrative management of the river by DOE almost every year necessitating considerable staff time. It would also cut down on the extra power production and irrigation which might otherwise occur during the abundant-water years.

Another way to look at the alternatives is in terms of the governmental options available to the proponent, DOE.

Viewed from this perspective the proposed action is to assume a position of leadership regarding state management concerns on the Columbia River. The department feels that although there are many federal, state, and local agencies dealing with portions of the resource, there needs to be an overall balancing effort against which to measure individual actions and plan future actions. DOE proposes to provide this effort as indicated in this document and the discussion it generates.

After the proposed action is adopted it becomes the official policy of the State of Washington. Unfortunately, making it the policy of the state does not directly cause it to happen or to become the policy of the federal government. Implementation will require the cooperation of many agencies in addition to those actions which DOE can take on its own. In addition, full implementation will take time.

No Action

The major alternative to adopting this leadership position is to not do so. This would continue the current situation of individual agency policies and project-by-project, ad hoc negotiation. Since the limitations of the resource are already being felt, this would allow the situation to worsen. Future efforts at establishing a policy would be further hampered by activities which would occur in the interim.

Focus on Control Points on the Columbia River in Washington

This was the original position of the DOE. In 1969, DOE's predecessor agency developed policies regarding water availability above Coulee Dam; in 1974 attention was focused on the Snake. In 1978, DOE proposed to establish water resource guidelines for the John Day/McNary Pools (Lake Wallula and Lake Umatilla). This was felt to be the most sensitive segment left since major power additions and many large irrigation projects were being proposed for this area. Many commentors criticized DOE for not considering the entire system in its analysis. The current proposal is meant to address this problem.

Leave it to Someone Else

It would be possible for DOE to not assume a leadership position and support another agency's efforts. However, because DOE is responsible for both water resources and water quality within the state and is the spokesman for the state in Federal-State water related issues, the agency must take actions whether there is an established policy or not. This means that DOE feels a pressing need for a policy whereas many other agencies which do not have direct permit authority do not. Left to someone else, the problem could drag on indefinitely. DOE feels that something must be done now.

VI. COMMITMENTS OF RESOURCES AND LONG-TERM, VERSUS SHORT-TERM USES OF THE ENVIRONMENT

The purpose of this program is to examine the commitments of the Columbia River resource and to determine the best balance of uses to avoid long-term environmental losses. The proposal involves trade-offs in power generation and irrigation water to provide flows for protection of instream resources including fish, wildlife, and recreation. Without flow protection, the anadromous fishery resource will continue to be in serious trouble as the river is used more extensively for peak power production and irrigation depletions increase. Wildlife would also be seriously affected by peak power production. If these resources are lost or severely limited, the range of beneficial uses of the Columbia River will be narrowed. This would affect the cultural and economic interests as well as the natural environment of many people.

If implementation of this program is delayed until some future time, the damage to the fish and wildlife resources may already be done. These resources are at or rapidly reaching critical survival levels.

This proposal will limit the operation of the hydroelectric system which will also affect many people. The biggest limitation will be on the use of the system to provide peak power. There may be an increased use of non-renewable resources such as coal or oil to provide this power.

This proposal will also limit irrigation diversions in low water years. While this is likely to result in reduced agricultural production, it is intended to help provide long-term protection to the instream resources of the river.

APPENDIX A

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Rock Island. Rm 453.5-474.
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APPENDIX B
Distribution List

Federal Agencies

Economic Development Administration
Bonneville Power Administration
U.S. Fish and Wildlife Service
National Marine Fisheries Service
Federal Energy Regulatory Commission
U.S. Bureau of Reclamation
U.S. Army Corps of Engineers
Heritage Conservation and Recreation Service
Bureau of Indian Affairs U.S.
U.S. Forest Service
Soil Conservation Service
U.S. Department of Justice
U.S. General Accounting Office
Environmental Protection Agency

State Agencies

Washington Department of Game
Washington Department of Fisheries
Washington Department of Social and Health Services
Washington Department of Agriculture
Washington Department of Natural Resources
Washington State Board of Tax Appeals
Washington Planning and Community Affairs Agency
Oregon Department of Water Resources
Oregon Department of Energy
Oregon Department of Fish and Wildlife
Idaho Department of Water Resources
California Water Resources Department
Washington State University
University of Washington
University of Oregon
University of California at Irvine
Utah State University
Colorado State University
University of British Columbia
Washington State Ecological Commission
House Agricultural Committee
House Ecology Committee
Oceanographic Institute of Washington

Other Agencies and Groups

Grant County PUD
Chelan County PUD
Douglas County PUD
Seattle City Light
Puget Sound Power and Light
Pacific Power and Light
Portland General Electric
Washington Water Power
Idaho Power Company
Northwest Rural Electric Cooperatives
Washington Public Power Supply System
Aluminum Company of America
Boise Cascade Corp.
Scott Paper Company
Texaco, Inc.
Bethlehem Steel Corp.
U & I Sugar, Inc.
Lone Star Industries
N.W. Pulp and Paper Association
Western Environmental Trade Association
Pacific Northwest Waterways Association
Washington Public Ports Association
Port of Vancouver
Port of Umatilla
Port of Chelan County
Association of Washington Businesses
Central Washington Grain Growers
North Pacific Grain Growers
Washington State Reclamation Association
Lower Stemilt Irrigation District
Washington State Farm Bureau
Pacific Northwest River Basins Commission
Columbia River Fisheries Council
Columbia River Basin Fishery Alliance
Columbia River Fishermen's Protective Union

Other Agencies and Groups (Continued)

Columbia River Intertribal Fish Commission
Yakima Indian Nation
Confederated Tribes of the Umatilla Indian Reservation
Federation of Independent Seafood Harvesters
Charter Boat Association
Lower Columbia Basin Audubon Society
Black Hills Audubon Society
Northwest Resource Information Center
League of Women Voters
Idaho Citizens Coalition
Richland Ecology Commission
Washington Environmental Council
Friends of the Earth
Seattle Shorelines Coalition
Oregon State Public Interest Research Group

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Marr Waddoups
Garin Wallace
Bruce D. Walters
Carol M. Warren
Dick Watson
Madge S. Watson
Philip C. Watson
Glen D. Weaver
Roy C. Webster
Prof. Ruth E. Weiner
Rebecca Weiss
Brig. Gen. Richard M. Wells
Larry Werkema
Don White
Sandra L. White
Senator Al Williams
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J. M. Williams
Kirk Williamson
Bob Wiltermood
Ken Wise
JoAnn Woodgerd
Leon Woodworth
Roger Woodworth
Pete Wyman
Mr. John Young, Jr.

APPENDIX C

Following is a list of "Elements of the Environment" as required by the SEPA GUIDELINES. Those elements marked N/A (not applicable) will not affect the area involved in the proposed program and are discussed in the text.

Elements of Physical Environment	Elements of Human Environment
Earth	N/A Population
N/A Geology	
N/A Soils	N/A Housing
N/A Topography	
N/A Unique physical features	Land Use Patterns
N/A Erosion	
N/A Accretion/avulsion	Transportation/circulation
	N/A Vehicular transportation generated
Air	N/A Parking facilities
N/A Air quality	N/A Transportation systems
N/A Odor	Movement/circulation of people and goods
N/A Climate	Waterborne, rail, and air traffic
	N/A Traffic hazards
Water	
Surface water movement	Public services
N/A Runoff/absorption	N/A Fire
N/A Floods	N/A Police
Surface water quantity	N/A Schools
Surface water quality	Parks and other recreational facilities
N/A Ground water movement	N/A Maintenance
N/A Ground water quantity	Other governmental services
N/A Ground water quality	
Public water supplies	Energy
	Amount required
Flora	Source/availability
Numbers or diversity of species	
N/A Unique species	Utilities
N/A Barriers and/or corridors	Energy
Agricultural crops	N/A Communications
	Water
Fauna	N/A Sewer
Numbers or diversity of species	N/A Storm water
N/A Unique species	N/A Solid waste
Barriers and/or corridors	
Fish or wildlife habitat	N/A Human health (including mental health)
N/A Noise	Aesthetics
N/A Light or glare	Recreation
Natural resources	N/A Archaeological/Historical
Rate of use	
N/A Nonrenewable resources	Economic
N/A Risk of explosion or hazardous emissions	N/A Additional population characteristics
	Distribution by age, sex, and ethnic characteristics of the residents in the geographical area affected by the environmental impacts by the proposal.

APPENDIX D

Public Information and Involvement in Columbia River Policy Planning

January 1974	Draft Snake River Policy for Mainstem Snake River in Washington.
February 1974	Public hearings in Walla Walla followed by partial implementation of proposed policies.
April 1976	Public workshop on Allocation and Use of Water Resources in the John Day/McNary Pools of the Columbia River (proceedings published and are available).
September 1976	Public discussion paper -- Discussion of Alternatives for John Day/McNary program.
November 1977	Program Document Review Draft (blue cover).
	Article in Waterline newsletter on John Day/McNary program (Distribution of 1600).
December 1977	Five public hearings (in counties affected by regulation, plus Vancouver, Washington).
December 1977	Article on John Day/McNary program in Washington Water News newsletter. (Distribution of 3500).
February 1978	Proposed Columbia/Snake System Planning Program.
March 1978	Ecological Commission meetings in Spokane, Tri-Cities, and Seattle.
April 1978	Article in Waterline on Columbia River program.
June 1978	Final EIS and Review Draft of Program Document and draft regulation (salmon cover).
June 29, 1978	First adoption hearing -- postponed to August 8.
August 8, 1978	Press Briefing.
August 8, 1978	Adoption Hearing.
September 1978	Article on John Day/McNary program and regulation and option in Washington Water News.
October 1978	Article in Waterline on adoption of John Day/McNary regulation.
November 2, 1977	Public meeting to discuss Columbia River Instream Resource Protection Program (CRIRPP) draft goals and objectives and management elements.

November 17, 1978	Monthly update sent to approximately 700 people.
December 5, 1978	Public meeting to discuss program status and evening meeting in Seattle:
December 15, 1978	Monthly update sent to approximately 700 people announcing January 24-25 Ecological :Commission meetings in Vancouver and Olympia and January 17 public meeting on CRIRPP:
January 1979	Article in Waterline on Columbia River Instream Resource Protection Program.
January 17, 1979	Public meeting to discuss status of CRIRPP.
January 24, 1979	Ecological Commission meeting on Columbia River water management in Vancouver, Washington.,
January 25, 1979	Ecological Commission regular quarterly meeting. One topic on agenda was status report on CRIRPP.
January 25, 1979	Ecological Commission meeting on Columbia River water management in Olympia, Washington.
February 15, 1979	Public meeting to discuss program status and information supplied to date.
February 23, 1979	Meeting in Vancouver with Columbia River Basin Fisheries Alliance to discuss Columbia River management and planning activities.
February 23, 1979	Monthly update sent to approximately 700 people announcing April 4-5 Ecological Commission meetings in Wenatchee and Richland, respectively, and the March 14 public meeting on CRIRPP in Olympia.
March 14, 1979	Public meeting to discuss status of CRIRPP.
April 4, 1979	Washington State Ecological Commission quarterly meeting. One item on agenda was status report on CRIRPP.
April 4, 1979	Washington State Ecological Commission meeting on Columbia River Water Management.
April 5, 1979	Briefing of representatives of the State of Oregon an status of CRIRPP.
April 5, 1979	Washington State Ecological Commission meeting on Columbia River Water Management.
February 5-6, 1980	Summary of program and proposed regulation mailed to approximately 300 people.
February 20, 1980	Public hearing on CRIRPP proposal in Vancouver, WA.

February 21, 1980	Ecological Commission quarterly meeting in Seattle, Washington plus evening public hearing on CRIRPP.
February 26, 1980	Public hearing on CRIRPP in Spokane, Washington.
February 27, 1980	Public hearing on CRIRFP in Wenatchee, Washington.
February 28, 1980	Public hearing on CRIRPP in Richland, Washington.
April 1, 1980	Close of public comment period.
June 23, 1980	Adoption proceeding in Lacey, Washington.

APPENDIX E

ACRE-FOOT: A unit for measuring the volume of water or sediment. It is equal to the amount of water needed to cover one acre of land with water one foot deep. This is 43,560 cubic feet, or 325,851 gallons.

ALLOCATION: The process of legally dedicating specific amounts of the water resource for application to beneficial uses by means of water rights.

AMBIENT: The natural conditions (or environment) at a given place or time.

ANADROMOUS FISH: Fish that spend a part of their lives in the sea but ascend rivers at more or less regular intervals to spawn. Examples: Salmon, some trout, shad, and striped bass.

ANNUAL STORAGE: See "storage reservoir."

APPROPRIATION: The administrative or physical process of obtaining water.

APPROPRIATION LIMIT: The maximum amount of appropriation permitted.

AQUIFER: An underground bed or stratum of earth, gravel, or porous stone which contains water. A geological rock formation, bed, or zone that nay be referred to as a water-bearing bed.

BASE FLOW: As defined in the Water Resources Act of 1971 (Ch. 90.54 RCW), base flows are the flows administratively established "necessary to provide for the preservation of wildlife, fish, scenic, aesthetic and other environmental values, and navigational values."

BASELOAD: The minimum load in a power system over a given period of time.

BIOCHEMICAL OXYGEN DEMAND (BOD): The amount of oxygen required to decompose a given amount of organic compounds to simple, stable substances within a specified time at a specified temperature. BOD serves as a guide to indicate the degree of organic pollution in water.

BLACKOUT: The disconnection of the source of electricity from all the electrical loads in a certain geographical area. The disconnection is brought about by an emergency-forced outage or other fault in the generation/transmission/ distribution system servicing the area.

BROWNOUT: An intentional reduction of energy loads in an area by the partial reduction of electrical voltages, which results in lights dimming and motor driven devices slowing down.

CAPACITY: Maximum power output, expressed in kilowatts or megawatts. Equivalent terms: peak capacity, peak generation, firm peakload, carrying capacity. In transmission, the maximum load a transmission line is capable of carrying.

CLOSURE: Administrative measure to keep water resources from further appropriation for consumptive uses. Generally, domestic household use and normal stock watering are exempted from closure when there is no practicable alternate source of supply.

COLIFORM: Any of a number of organisms common to the intestinal tract of man and animals, used as an indicator of water pollution.

CONFLUENCE: A place where two or more streams meet; the point where a tributary joins the main stream; a fork.

CONJUNCTIVE USE: The combined use of ground and surface water in order to increase the benefits of all water use.

CONSUMPTIVE USE: The amount of water used in such a way that it is no longer directly available. Includes water discharged into the air during industrial uses, or given off by plants as they grow (transpiration), or water which is retained in the plant tissues, or any use of water which prevents it from being directly available.

CONSUMPTIVE USE REQUIREMENT (crop): The amount of consumptive use for irrigation each year for a particular type of crop. Measured in acre-feet or feet per acre.

CONTROL STATION: Any streamflow measurement site at which a regulatory base flow has been established.

COOLING TOWER: A tower in which the waste heat of a powerplant is disposed of through the evaporation of water.

CRITICAL PERIOD: The "worst-case" conditions as determined by applying the lowest streamflows on record to the current storage capacity. This is done to determine the maximum firm load-carrying capability of the present system under these "worst-case" conditions.

CUBIC FEET PER SECOND (cfs): A unit of measure for the rate of discharge of water. One cubic foot per second is the rate of flow of a stream where one square foot is flowing at one foot per second. It is equal to 448.8 gallons per minute.

CURTAILMENT: Temporary and mandatory load reduction of power under emergency conditions.

DEMAND: The rate at which electric energy is delivered to or by a system, expressed in kilowatts or megawatts, kilovoltamperes, or over any designated period.

DEPENDABLE CAPACITY: The load-carrying ability of a station or system under adverse conditions for the time interval and period specified when related to the characteristics of the load to be supplied.

DESCALING: Loss of scales on a fish often caused by abrasion or rough handling; can increase susceptibility to infection and upset regulation of internal salt/water balance.

DISCHARGE: In simplest form, discharge simply means outflow. The term can describe the flow of water from a faucet or from a drainage basin covering hundreds of square miles.

DISSOLVED OXYGEN: Amount of oxygen dissolved in water; reductions below saturation can be damaging to fish and fish eggs.

DISSOLVED SOLIDS: The total amount of dissolved material, organic and inorganic, contained in water or wastes. Excessive dissolved solids can make water unsuitable for industrial uses and/or unpalatable for drinking.

DIURNAL: Having a daily cycle.

DIVERSION: The physical act of removing water from a stream or other body of surface water.

DRAINAGE AREA: The area of land drained by a stream, measured in the horizontal plane. It is the area which is enclosed by a drainage divide.

DRAINAGE BASIN: A part of the surface of the earth that is occupied by a drainage system consisting of a surface stream or a permanent body of water together with all tributary streams and bodies of impounded water (lakes, ponds, reservoirs, etc.).

EFFLUENT: A discharge or emission of a liquid or gas, usually waste material.

EMISSION,., A discharge of pollutants into the atmosphere, usually as a result of burning or the operation of internal combustion engines.

EMISSIONS: Material that is released into the air either by a distinct source (primary emission) or as the result of a photochemical reaction or chain of reactions.

ENDANGERED SPECIES: Any species which, as determined by the Fish and Wildlife Service, is in danger of extinction throughout all or a significant portion of its range other than a species of the class Insecta determined to constitute a pest whose protection would present an overwhelming and overriding risk to man.

ENERGY: The ability to do work; the average power production over a stated interval of time; expressed in kilowatt hours, megawatt hours, average kilowatts, or average megawatts. Equivalent terms: energy capability, average generation, firm energy load carrying capability.

ENERGY CAPABILITY: The net average output ability of a generating plant or plants during a specified period longer than one day. Energy capability may be limited by available water supply, plant characteristics, maintenance, or fuel supply.

ENTRAIN:. To carry along or over, especially mechanically (as fine drops of liquid in vapors during distillation of evaporation).

ESCAPEMENT: Adult fish that "escape" fishing gear to migrate upstream to spawning grounds.

ESTUARY: Shallow coastal water, usually associated with the mouth of a river, including adjoining bays, lagoons, shallow sounds, and marshes where tidal effects are evident and fresh water and sea water mix.

FALLBACK: Occurs when adults exiting a fish ladder into the forebay pass back downstream over the spillway or through the turbines with associated mortalities; survivors which use the ladder again artificially increase the number of recorded returning adults by being counted twice.

FINGERLINGS: Fish whose size ranges from approximately one to three inches.

FIRM POWER: Power intended to be available at all times during the period covered .by a commitment, even under adverse conditions, except for certain uncontrollable forces or service provisions. Equivalent terms: prime power, continuous power, assured power. Component terms: firm energy, firm capacity, dependable capacity.

FIRM POWER TRANSFER: The reservation of capacity in a utilities transmission system for the transfer of another utility's power and energy.

FISH LADDER: A water passage around or through an obstruction to enable fish to ascend without undue stress.

FISH SCREEN: A screen over a water intake to prevent fish from entering.

FLIP-LIP: Common name for spillway flow deflector which reduces nitrogen supersaturation by preventing water spilled over mainstem dams from plunging deep into stilling basins.

FLOOD: Any relatively high streamflow or an overflow that comes from a river or body of water and which causes or threatens damage.

FLOOD PLAIN: Lowland bordering a river, subject to flooding when stream overflows.

FLYWAY: The route taken by migratory birds, usually waterfowl, during migration.

FORAGE: All parts of current leaf and twig growth of shrubs, woody vines, and trees as well as herbaceous food that is available to livestock or game animals.

FOREBAY: The impoundment immediately above a dam or hydroelectric plant intake structure.

FRESHET: A surge of water in a stream caused by heavy rains or melting snow.

FRY: Young fish from the time of hatching to approximately one inch in size.

GAGING STATION: A particular location on a stream, canal, lake, or reservoir where systematic measurements are made on the quantity of water flow.

GILLNET: A net suspended vertically in the water which entangles the heads of fish.

GROUND WATER: Water in the ground lying in the zone of saturation. Natural recharge includes water added by rainfall, flowing through pores or swell openings in the soil into the water table.

HABITAT: The natural abode of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting life.

HEAD: Essentially, the vertical height of the water in the reservoir above the turbine; that is, the difference between the elevation of the forebay of the reservoir and the tailrace at the foot of the dam.

HEAVY METALS: A group which includes all metallic elements with atomic numbers greater than 20, .the most familiar of which are chromium, manganese, iron, cobalt, nickel, copper and zinc but also include arsenic, selenium, silver, cadmium, tin, antimony, mercury, and lead, among others.

HOLDOVERS: Fish that take up residence in reservoirs rather than completing migration to the sea; may complete migration the following year.

HYDRAULIC CONTINUITY: A cause and effect relationship between water under the ground with water standing or flowing on the surface.

HYDROGRAPH: A graph showing varying streamflow (or stream discharge) with respect to time during a year as determined at a specific cross-sectional location in the stream.

HYDROLOGIC CYCLE: The continual exchange of moisture between the earth and the atmosphere, consisting of evaporation, condensation, precipitation (rain or snow), stress runoff, absorption into the soil, and evaporation in repeating cycles.

HYDROPOWER: A term used to identify a type of generating station, power, or energy output in which the prime mover is driven by water power.

ICE TRASH SLUICEWAYS: A channel provided in certain dams to facilitate the passage of ice and trash by the dam. These sluiceways are being studied to determine their potential for downstream fish passage.

IMPOUNDMENT: A body of water formed by confining and storing the water.

INDUSTRIAL FIRM POWER: Power intended to have assured availability to the industrial customer on a contract demand basis.

INSTANTANEOUS FLOW: The flow at any specific point in time (as opposed to average).

INSTREAM VALUE: The attitude of society towards the instream use of water for aesthetic, fish and wildlife, recreation, hydroelectric, and general environmental purposes.

INTERRUPTIBLE LOADS (interruptible power): Loads (power) that, by contract, can be interrupted in the event of a capacity deficiency on the supplying system. The interruptible loads are usually heavy industrial segments on the Bonneville Power Administration system.

ISOTOPES: Any of two or more species of atoms of an element with different atomic mass and with different physical properties.

KCFS: Thousand cubic feet per second (see cubic feet per second).

KILOWATT (Kw): The electrical unit of power which equals 1,000 watts.

KILOWATT HOUR (Kwh): A basic unit of electrical energy which equals one kilowatt of power applied for one hour.

LEACHING: The process by which the more soluble material is washed out of soil by percolating rain water.

LIVE STORAGE: The volume of a reservoir exclusive of dead and surcharge storage capacity.

LOAD: The amount of electric power delivered to a given point on a system.

LOAD FACTOR: The ratio of the average load to the peak load during a specified period of time, expressed in percent.

LOAD MANAGEMENT: Influencing the level and state of the demand for electrical energy so that demand conforms to individual present supply situations and long-run objectives and constraints.

LOCK: An enclosure with gates at each end used in raising or lowering water level.

MEGAWATT (Mw): The electrical unit of power which equals one million watts or one thousand kilowatts.

MEGAWATT HOUR (Mwh): A basic unit of electrical energy which equals one megawatt of power applied for one hour.

NAMEPLATE RATING: The full-load continuous rating of a generator under specified conditions as designated by the manufacturer. It is usually indicated on a nameplate attached mechanically to the individual machine or device.

NONCONSUMPTIVE USE: Use of water in a manner which does not consume the resource. Fishery, aesthetic, and hydropower uses are examples of nonconsumptive use.

NONFIRM ENERGY: Energy which is subject to interruption or curtailment by the supplier and hence, does not have the guaranteed, continuous, availability feature of firm power.

NONFIRM POWER: Electric power available during surplus period, which can be interrupted by the supplying party for any reason.

OFF-PEAK: A period of relatively low system demand for electrical energy as specified by the supplier, such as in the middle of the night.

OPERATING CAPACITY: The actual amount of power that can be produced by a generating unit., This may be as much as 20 percent more than nameplate rating for relatively short periods of time.

OUTAGE: In a power system, the state of a component (such as a generating unit or a transmission line) when it is not available to perform its function due to some event directly associated with the component.

PARR: Young or anadromous trout that have not yet become smolts.

PEAKING: Operation of generating facilities to meet maximum instantaneous electrical demands.

PEAKING CAPABILITY: The maximum peakload that can be supplied by a generating unit, station, or system in a stated time period. It may be the maximum instantaneous load or the maximum average load over a designated interval of time.

PEAKING CAPACITY: Generating equipment normally operated only during the hours of highest daily, weekly, or seasonal loads Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on round-the-clock basis.

PEAK/ENERGY EXCHANGE: Exchange of peaking capacity for offpeak energy return between two or more electrical energy producing systems.

PEAKLOAD: The maximum electrical load consumed or produced in a stated period of time. It may be the maximum instantaneous load (or the maximum average load) within a designated interval of the stated period of time.

PENSTOCK: The tube which carries the water from the forebay to the turbine of a hydroelectric generating unit.

PERENNIAL STREAM: A stream, at any given location, is considered perennial if its natural flow is normally continuous.

pH: The negative logarithum of the hydrogen-ion concentration, a pH below 7.0 denotes acidity, a value greater than 7.0 indicates alkaline solution.

POLLUTANT: A residue (usually of human activity) which has an undesirable effect upon the environment (particularly of concern when in excess of the natural capacity of the environment to render it innocuous).

PONDAGE RESERVOIR: A reservoir which provides sufficient storage for daily or weekend regulation of flow.

POWER: The time rate of transferring or transforming energy for electricity, expressed as watts.

PRECIPITATION: The discharge of water (such as rain, snow, hail) out of the atmosphere, generally onto land or water surfaces. This is the process which permits atmospheric water to become surface or subsurface water. The term precipitation is often used to describe the amount of water that is precipitated.

PUBLIC INTEREST: The sense of local, county, or state values at a given point in time.

PUBLIC WATERS: All waters not previously appropriated.

PUD: Public Utility District (in Washington) or Peoples' Utility District (in Oregon). These are separate units of government established by voters of the proposed district. The PUD's hold, "preference customer" status in buying BPA power.

PUMPED STORAGE: An arrangement whereby a reservoir is filled with water by pumping during off-peak periods when low-cost steam energy is available or when water is being spilled at other hrydroplants. This method of operating a hydroplant can store water for use at a more appropriate time, or it can save water which would otherwise be lost. It is an arrangement whereby additional electric power may be generated during peakload periods by hydraulic means, using water pumped into a storage reservoir during off-peak periods.

REARING AREA: The place where juvenile fish live. It must meet certain environmental requirements for food supply, cover, and temperature.

REDD: The spawning ground or nest of various fish.

RESERVATION: An approved priority claim to water for a future beneficial use.

RETURN FLOW (irrigation): Irrigation water which is not consumed in evaporation or plant growth and which returns to a surface stream or ground water aquifer.

RELINQUISHMENT: Returning to the state a right to divert or withdraw water.

RIPARIAN: Pertaining to the banks of streams, lakes, or tidewater.

RIVER BASIN: The total area drained by a river and its tributaries; watershed; drainage basin.

RUN: A group of fish that ascend a river to spawn.

RUNOFF: That part of precipitation which appears to surface streams. This is the streamflow before it is affected by artificial diversion, reservoirs, or other man-made changes in or on stream channels.

RUN OF RIVER DAM: A hydroelectric plant with little or no ability to regulate flow.

SALMONOID: Fish belonging to the family salmonidae, including salmon, trout, char, and allied freshwater and anadromous fishes.

SECONDARY ENERGY: Electric energy surplus to the needs of a supplier, the delivery of which may be interrupted for any reason by the supplier.

SECONDARY POWER: Power not having the assured availability of firm power; power that is available from a system intermittently and that is used to serve markets that can accommodate such power. Equivalent terms: nonfirm power, surplus power, secondary energy.

SMOLT: An anadromous fish that is physiologically ready to undergo the transition from fresh to salt water; age varies depending on species and environmental conditions.

SMOLTIFICATION: The biological process whereby an anadromous fish becomes capable of undergoing the transition from fresh to salt water.

SPAWNING: The laying of eggs, especially by fish.

SPILLWAY: The channel or passageway around or over the dam through which excess water is spilled around the turbines.

STORAGE: Water naturally or artificially impounded in surface or underground reservoirs.

STORAGE RESERVOIR: A reservoir in which storage is held over from the annual high-water season to the following low-water season. Storage reservoirs which refill at the end of each annual high-water season are "annual storage" reservoirs. Those which cannot refill all usable power storage by the end of each annual high-water season are "cyclic storage" reservoirs.

STORAGE SERVICE: A service which a utility provides by receiving energy reducing the generation and water discharge at one of its reservoirs and thereby storing energy in the form of water in that reservoir. At a later time the stored water may be released and the stored energy returned.

STREAMFLOW: The discharge or water flow that occurs in a natural channel. The word discharge can be applied to a canal, but streamflow describes only the discharge in a surface stream course. Streamflow applies to discharge whether or not it is affected by diversion or reservoirs.

STREAM-GAGING STATION: A measuring facility located adjacent to a stream which measures the rate at which water passes a given point in a stream or river.

STREAM MANAGEMENT UNIT: Stream segments reaches, or tributaries, each containing a control station, which are identified as units for defining base flow levels.

SURFACE RUNOFF: That part of the precipitation which travels over the soil surface to the nearest stream channel.

SURPLUS ENERGY: Electric energy generated at Federal hydroelectric plants in the Pacific Northwest which cannot be conserved. This energy would otherwise be wasted because of the lack of market for it in the Pacific Northwest at any established rate. When the non-firm energy needs of the Pacific Northwest entities are satisfied, surplus energy then becomes available for marketing outside the Pacific Northwest.

SURPLUS POWER: Power that is in excess of the needs of the producing system. For the region, surplus power would be exported to serve markets in adjacent areas. Sometimes used as interchangeable term with secondary power.

SUSPENDED SOLIDS: Solids suspended in wastewater. The amount of suspended solids is a measure of the polluting effect of the wastewater.

SYSTEM RESERVE CAPACITY: The difference between the available dependable capacity of the system including net firm power purchases, and the actual or anticipated peak load for a specific period.

TAILRACE: The portion of s stream just below a dam; the water flowing from the draft tubes of a turbine.

THERMAL POLLUTION: The warming of the environment, especially streams and other bodies of water, by waste heat from power plants and factories. Drastic thermal pollution endangers many species of aquatic life.

THREATENED SPECIES: Those species, as determined by the Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all of a significant portion of their range.

TRIBUTARY: A stream that contributes its waters to a larger stream by discharging into it.

TURBIDITY: A discoloration of water due to the presence of suspended particules, organic matter, or other pollutants.

TURBINE: A rotary engine actived by the reaction and/or impulse of a current of pressurized fluid, (water, steam, liquid metal, etc.) and usually made with a series of curved vanes on a central rotating spindle.

UPLAND GAME: Huntable animals living on land forms other than near river, streams, lakes, swamps, or seas.

WASTE, HIGH LEVEL RADIOACTIVE: Wastes having radioactivity concentrations of hundred of thousands of curies pre gallons or cubic foot.

WASTE, LOW LEVEL RADIOACTIVE: Wastes having radioactivity concentrations in the range of one microcurie per gallon or cubic foot.

WASTE, RADIOACTIVE: Equipment and materials (from nuclear operations) which are radioactive and for which there is not current use.

WATERSHED: The area from which water drains to a single point. In a natural basin, the area contributing flow to a given place on a stream.

WATER RIGHT: A legal right and property interest (subject to certain limitations) to obtain specific maximum quantities of water from specific sources for application to beneficial use.

WEIR: Barriers or dams which control water level in a waterway or pool.

WITHDRAWN: The administrative procedure of closing a water supply source from further appropriation for an indefinite period of time. RCW 98.54.050(2). Also, the removal of ground water from its source.

APPENDIX F

Biology of Columbia Basin Salmon and Steelhead

Pacific salmon belong to the genus Oncorhynchus. The most often used common and scientific names for the five species found in Washington State are: pink or humpback salmon (O. gorbuscha), chum or dog salmon (O. keta), sockeye or red salmon (O. nerka), chinook or king salmon (O. tshawytscha), and coho or silver salmon, (O. kisutch). Pink salmon are not discussed here because they do not occur in large numbers south of Puget Sound. The fifth type of anadromous fish important in the Columbia Basin is the steelhead trout (Salmo gairdneri).

Life Cycle

The four species of Columbia River salmon have many similarities in their biology and life histories. Adult salmon enter freshwater rivers and streams, the exact time differing between stocks and species. Generally, the female, upon choosing a suitable spawning site, digs a nest or "redd" in the streambed. The male remains in close attendance, courting the female and fending off competing males. When the redd is completed, the female drops into it and releases some of her thousands of eggs, the numbers varying between species and size of individual. At this moment the male moves alongside his mate and releases milt, thus fertilizing the eggs. The female with snout, fin, and tail then covers the eggs while the male returns to his post to resume vigilance. This sequence of redd-building, courting and spawning is repeated until the sex products of both male and female are exhausted. Routinely, after spawning, the female drives off the male and guards the redd until death.

Of the eggs spawned, some hatch while others are lost as a result of poor stream conditions or predation by trout and other stream fishes. The time required for hatching is influenced by the temperature of the stream. The newly hatched salmon, or alevin, remain hidden in the gravels on the streambed until spring. Receiving nourishment from a yolk-sac attached to the underside of its body, the alevin gradually transform into miniature salmon, and in the spring emerge from the gravel as a fry. Depending on the species, the fry either migrate immediately to sea, remain in the stream or river for a few months, or take up lake-residence for a year or two before going to sea.

Some of the differences in salmon life histories are discussed below.

Chum

Chum salmon enter the Columbia River from mid-October through November destined for spawning grounds in the lower Columbia River, primarily Washington tributaries. Most fry migrate immediately to saltwater after emerging from spawning gravels, but some feed in freshwater for a month or so. Chum salmon usually mature in their third to fifth year (occasionally in their second or sixth year), and typically weigh between 5 and 20 pounds, although some may approach 30 pounds.

Sockeye

Sockeye salmon enter the Columbia River in June and July, almost exclusively destined for Columbia River tributaries above Priest Rapids Dam. Most sockeye salmon develop through the alevin stage in the gravel of their freshwater spawning areas. They then move into nursery lakes where they spend one to two more years in freshwater before migrating to sea. The only two nursery lakes left in Washington State are Wenatchee Lake and Lake Osoyoos. Columbia sockeye salmon mature and spawn in their third or fourth year. Adults typically weigh 5 to 8 pounds.

Chinook

Chinook salmon mature between their second and fifth year, usually in their fourth or fifth year. The young fish feed in fresh or brackish water for periods of a few months to a year or longer before they migrate to sea. Because of this long period in freshwater, chinook salmon are particularly vulnerable to damage from dams; pollution, irrigation, and other land and water use activities.

Chinook are known for their 1arge size and long migrations to spawning grounds. They have been known to approach 100 pounds at maturity, but weights of 15 to 40 pounds are more typical. Some Yukon River chinook salmon spawn 2,000 miles from the ocean, and before dams were built an the river, Columbia River fish also made long migrations. They are divided into three major groups: spring, summer, and fall, depending on when the adults enter fresh water and location and time of spawning.

The spring chinook run is composed of two major segments, a lower river run destined for tributaries below Bonneville Dam, and an upper river run destined for tributaries above Bonneville. The lower river spring chinook run enters the Columbia River from February through May ,with peak abundance in late March and early April. Upriver (above Bonneville Dam) spring chinook enter the Columbia River in late March through May. Peak passage at Bonneville Dam normally occurs in late April or early May. This segment is primarily composed of fish produced in the Snake River system with supporting production from Columbia River tributaries above McNary Dam and mid-river tributaries between McNary and Bonneville Dams.

Summer chinook enter the Columbia River from late May through July. The run is composed of two distinct segments, one destined primarily for the Salmon River drainage in Idaho, the other for tributaries of the Columbia River above its confluence with the Snake.

The fall Chinook run is composed of two major segments, a lower river run destined for tributaries below Bonneville Dam and an upper river run destined for mid-river tributaries and hatcheries between Bonneville and McNary Dams, the Hanford Reach; and Snake River. Lower river fall chinook enter the Columbia River from early August through October destined for tributaries below Bonneville Dam. Up-river fall chinook enter the Columbia River during August. Peak passage at Bonneville Dam occurs in early September.

Coho

Coho enter the Columbia River from August to November with the vast majority destined for tributaries and hatcheries below Bonneville Dam. Juvenile coho typically remain in freshwater for two years before migrating to the ocean. Adults, which mature in their second to fourth year, commonly weigh between 6 to 12 pounds, and occasionally as much as 20 pounds.

Steelhead

The steelhead is a rainbow trout that migrates to sea and returns to freshwater for spawning. Fry may migrate immediately to sea, but most spend at least one year in freshwater and some as many as four years. They may spend one to four years at sea. Unlike the Pacific salmon, all of which die after spawning, the steelhead may survive to spawn a second or third time. The sport fishery is confined to returning fish in rivers: Average weight of returning adults is 6 to 10 pounds, though rare specimens over 40 pounds have been taken.

Steelhead, like chinook, are divided into groups depending on when the adults enter freshwater. Summer steelhead enter the Columbia River from April through October. Peak abundance occurs from July through early September. Some are destined for lower river tributaries, particularly Washington streams planted with hatchery fish. Most are destined for tributaries above Bonneville Dam.

The up-river run is composed of two segments. An early (group A) segment composed of smaller fish is produced in tributaries throughout the mid and uppper Columbia and Snake River drainages. The larger, later (group B) fish spawn primarily in the Clearwater River drainage in Idaho.

Winter steelhead enter the Columbia River from November through April.

Downstream Migration

At some time in their first or second year of life, all anadromous fish (unless they are landlocked, such as kokanee) respond to a number of internal and external "triggering" factors and begin their long migration to sea. Two of the most important migration cues are day length and water temperature; thus, migration may not always begin at exactly the same time every year. As mentioned in the life cycle section above, the timing of downstream migration is also different both between and within species. The approximate downstream passage patterns at Bonneville Dam are shown in Figure F-1.

There is a great deal more involved in going from freshwater to saltwater than simply swimming downstream. Table F-1 lists fifteen physiological changes that must occur as part of the overall "smolting" process. Some of these changes are readily visible, such as loss of the protection "parr marks" that provide a juvenile salmon with cryptic coloring.

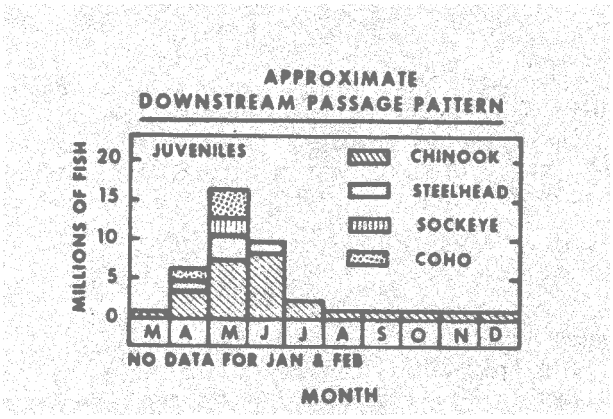


Figure F-1

Source: PNRBC, Seasonality of River Use (CRT 15), December 1975.

Table F-1. Physiological changers occurring during the parr-smolt transformation of Pacific salmon (Oncorhynchus) and Atlantic salmon (Salmo salar). All of these changes must be evident and properly coordinated to ensure acceptable health and adequate smolt functionality.

Physiological characteristics	Level in smolts compared with parr
1. Body silvering	Increases
2. hypoosmotic regulatory capability	Increases
3. Salinity tolerance and preference	Increases
4. Weight per unit length (condition factor)	Decreases
5. Growth rate	Increases
6. Body total lipid content	Decreases
7. Oxygen consumption	Increases
8. Ammonia production	Increases
9. Liver glycogen	Decreases
10. Blood glucose	Increases
11. Endrocrine activity Increases	Increases
a. thyroid (T-4)	
b. Interrenal	
c. pituitary (growth hormone, prolactin)	
12. Gill microsome, Na^+-K^+ ATPase enzyme activity	Increases
13. Ability to grow well in full-strength sea water (salinity 35%)	Increases
14. Buoyancy (swimm bladder, Atlantic salmon)	Increases
15. Migratory behavior	Increases

SOURCE: U.S. Fish and Wildlife Service

The onset of body silvering greatly increases vulnerability to predators: In addition, migrants are relatively easy targets for predators because the latter can wait for the food to come to them. Young salmon partially counteract this by making their seaward migration usually at night and staying near cover during the day. When the water is muddy, young salmon will migrate day or night.

Other changes are internal, such as the increased activity of gill ATPase, an enzyme that allows salmon and steelhead to survive the harsh transition from a freshwater to a saltwater environment. When in freshwater, the bodies of all fish have a higher salt content than their environment, and freshwater tends to permeate into their bodies through gills, gut, and skin. The amount of freshwater which would enter the body would soon be fatal if there were no mechanism to eliminate it. Freshwater fish cope with this problem by producing large quantities of very dilute urine. This water removal requires energy which, in turn, requires additional food. Gill ATPase is always present in these fish, but its activity is at a fairly low level during the freshwater phase of their life. This enzyme reacts to the high salt concentrations in seawater by "pumping" salt molecules out of the fish's blood faster than they "leak" in. If this does not occur, salt levels in the blood quickly reach lethal levels and the fish dies. Thus gill ATPase is not necessary to a fish in freshwater but is vital to the same fish once it enters seawater. Certain forms of water pollution, such as heavy metals and herbicides, or prolonged exposure to water warmer than 54° F, can destroy gill ATPase. An additional complicating factor is that ATPase is active in a smolt for only a limited time. Gill ATPase has been correlated with a fish's urge to migrate to sea. Thus a delay of as little as two weeks can result in "desmoltification" and fish who have no desire to swim to sea, commonly known as holdovers or residuals. These holdovers suffer a high rate of mortality, apparently from disease, predation, and lack of food. Those that do survive then become predators on future migrating fish. A few may smolt again the following year and migrate to sea.

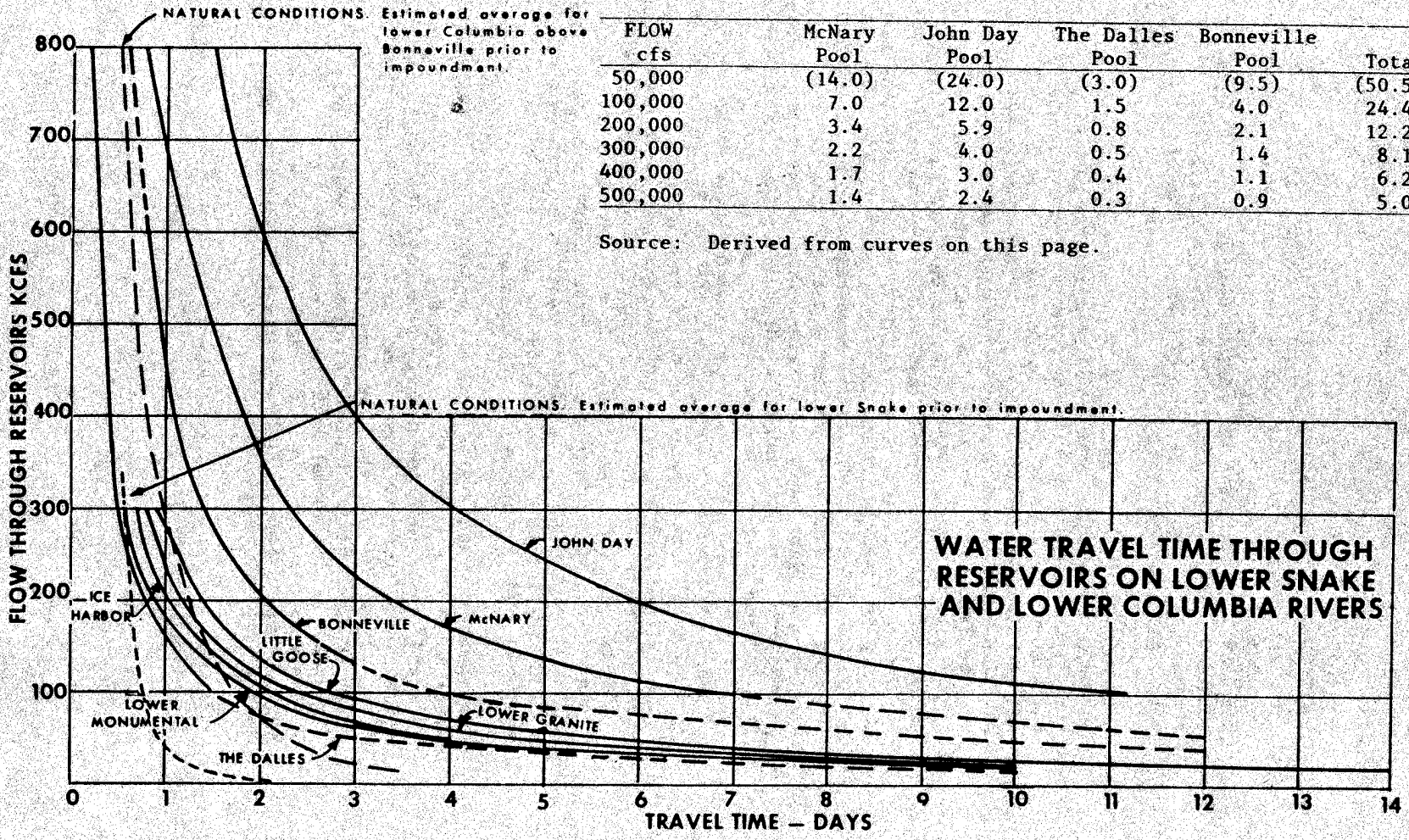
Travel time for downstream migrants approximates the speed at which the water moves. To illustrate, Figure F-2 shows the relationships between flow and travel time for McNary, John Day, The Dalles, and Bonneville pools, which occur in sequence on the Columbia below the Snake River. At a flow of 100,000 cfs, the combined passage time would be about 24 days; at 200,000 cfs about 12 days; and at 500,000 cfs, which was an often experienced annual peak flow level until recent upstream storage was developed, about five days. Before dams were built on the Columbia system, travel time through that stretch would have been less than two days.

FLOW-THROUGH TIME

(Days)

FLOW cfs	McNary Pool	John Day Pool	The Dalles Pool	Bonneville Pool	Total
50,000	(14.0)	(24.0)	(3.0)	(9.5)	(50.5)
100,000	7.0	12.0	1.5	4.0	24.4
200,000	3.4	5.9	0.8	2.1	12.2
300,000	2.2	4.0	0.5	1.4	8.1
400,000	1.7	3.0	0.4	1.1	6.2
500,000	1.4	2.4	0.3	0.9	5.0

Source: Derived from curves on this page.



Source: (Boyer, 1974)

Figure F-2

Upstream Migration

As discussed earlier in the life cycle section, the time of year and age of adult salmon entering freshwater varies depending on species and stock. By some mechanism not yet fully understood, adult salmon "home in" on the stream where they hatched (or were released) and return there to spawn. While in saltwater, salmon feed heavily and grow rapidly; however, they do not eat once they enter freshwater. Thus, any delay in reaching the spawning ground (e.g. obstructions or poor water quality which result in reduced swimming speed) may exhaust the fish's energy, stores and prevent spawning. If return per spawner falls below 1.0, the population will decline.

APPENDIX G

A Plan for Managing Fisheries on Stocks Originating from the Columbia River and its Tributaries Above Bonneville Dam

Background

In 1969, U.S. District Judge Robert Belloni rendered a decision in the case of Sohappy v. Smith (United States v. Oregon) (302 Fed. Supp. 899). This decision was favorable to the plaintiffs who objected to the State of Oregon regulations of off-reservation treaty fishing rights on the Columbia River system. Subsequent litigation led to an April 1974 ruling in which Judge Belloni adopted the 50-50 Indian-non-Indian allocation formula from the recently decided case of United States v. Washington (the "Boldt case") which applied only to northwestern Washington State. A further order, issued in August 1975, required the states of Washington and Oregon, in cooperation with the plantiffs, to develop a comprehensive plan which would implement the principles established since the 1969 decision. After extensive negotiation, such a plan entitled "A Plan for Managing Fisheries on Stocks Originating from the Columbia River and its Tributaries Above Bonneville Dam" was adopted by the States and the four plaintiff tribes (Nez Perce, Umatilla, Warm Springs, and Yakima) in early 1977.

Overview

The plan establishes allocations to treaty and nontreaty user groups for each harvestable fish run destined to return to spawning grounds above Bonneville Dam. Escapement goals designed to assure harvestable runs must be met before significant fishing is allowed. The plan provides for Indian ceremonial and subsistence fishing. As a concession to sports fisherman, the tribes have agreed to forego a commercial fishery of steelhead.

The states have agreed to pursue enactment of regulations by the Pacific Fishery Management Council to insure adequate returns of mature fish to the river. The plan also calls for the establishment of technical advisory committee composed of representatives from Oregon, Washington, Idaho, the National Marine Fisheries Service, the United States Fish and Wildlife Service, and each of the four Indian tribes to help government agencies implement and enforce the agreement. The plan will be tried for five years, after which it may be dropped or renegotiated.

The text of the plan is on the following pages.

A PLAN FOR MANAGING FISHERIES ON STOCKS ORIGINATING FROM THE COLUMBIA RIVER AND ITS TRIBUTARIES ABOVE BONNEVILLE DAM

The purpose of the plan shall be to maintain, perpetuate and enhance anadromous fish and other fish stocks originating in the Columbia Rover and tributaries above Bonneville Dam for the benefit of present and future generations, and to insure that the Nez Perce Tribe of Idaho, Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes. and Bands of the Yakima Indian Nation, hereinafter called Tribes, having the right to fish based on a treaty with the United States are accorded, the opportunity for their fair share of harvest, and to provide for a fair share of the harvest by non-treaty user groups.

This plan is based upon the unique circumstances relating to the Columbia River system and the parties hereto and does not necessarily have application in other fisheries.

The parties also recognize the substantial management problems resulting from the ocean harvest of mixed stocks of anadromous fish originating from the upper Columbia River and its tributaries and the wastage resulting from fishing on immature stocks. The parties will continue joint efforts to collect and gather data on this fishery and reduce inefficient and wasteful harvest methods.

Due to environmental factors totally unrelated to the treaty or nontreaty fisheries, there has been a continual decline of some runs of anadromous fish in the Columbia River system. This trend could deprive not only the treaty Indians, but also other user groups of the opportunity to harvest anadromous fish. The parties pledge to work cooperatively to maintain the present production of each run, rehabilitate runs to their maximum potential and to work towards the enhancement and development of larger and additional runs where biologically and economically feasible.

(1) The managing fishery agencies shall make every effort to allocate the available harvest as prescribed in this agreement on an annual basis. However, because run size cannot always be accurately calculated until some lower fishery has taken place, annual adjustment of the sharing formulas for each species will be required to provide the appropriate shares between treaty and nontreaty users. If treaty and nontreaty users are not provided the opportunity to harvest their fair share of any given run as provided for in this plan, every effort shall be made to make up such deficiencies during the next succeeding run of the same species. Overall adjustments shall be made within a 5-year time frame.

(2) The treaty Indian tribes and state and federal agencies shall diligently pursue and promote through cooperative efforts the upriver maintenance and enhancement of fish habitat and hatchery rearing programs, and so far as practicable, maintain present production of each run and to rehabilitate runs to their maximum potential.

(3) Hatchery salmon and steelhead released to maintain or restore runs above Bonneville Dam shall be shared pursuant to this plan.

(4) A technical advisory committee shall be established to develop and analyze data pertinent to this agreement, including but not limited to the following: calculated run size for all species of fish, ocean catches, escapement goals, catch allocation and adjustments, dam loss, habitat restoration, and hatchery rearing programs. Such a committee shall make recommendations to the managing fishery agencies to assure that the allocations in this agreement are realized. Members shall be qualified fishery scientists familiar with technical management problems on the Columbia River. The committee shall be comprised of representatives named by each of the three states, Oregon, Washington, Idaho, National Marine Fisheries Service. U. S. Fish and Wildlife Service and each of the Indian Tribes.

(5) Each party shall develop a catch record program that utilizes reliable statistical methods and effective enforcement procedures as developed by the .committee. Indian tribes shall report on appropriate state forms for each species ceremonial, subsistence and any other catch not sold to licensed state buyers. The states shall report and make available to all interested parties treaty and nontreaty sport and commercial catch for each species. All the above reports shall be made within an agreed-upon time schedule.

(6) The states agree to enact or recommend for enactment by the Pacific Fisheries Management Council appropriate conservation regulations for the ocean fishery that will assure an efficient utilization of stocks and will provide for adequate escapement of mature fish into the Columbia River to achieve the goals and purposes of this plan. Marine regulations should attempt to harvest mature fish and reduce waste.

(7) Fish escapement totals, dam loss estimates, or other technical aspects of this agreement may be modified by mutual agreement to reflect current data. In the event that significant management problems arise from this agreement that cannot he resolved by mutual agreement, the parties agree to submit the issues to federal court for determination. In any event, the Court shall retain jurisdiction over the case of U. S. v. Oregon, Civil 68-513, (D.C. Or).

(8) The sharing formulas as set forth in this plan are based upon the premise that the marine area catches in U. S. controlled waters of fish originating above Bonneville Dam, other than fall chinook and coho runs, will be regulated by PMIC so as to be essentially de minimis portions of those runs. The parties acknowledge that if subsequent data should indicate that this premise is incorrect, these formulas may require revision.

(9) Regulations affecting treaty users which are enacted in conformity with this comprehensive plan shall be considered as complying with the court's decrees enunciated in U. S. v. Oregon, Civil No. 68-513, District of Oregon.

(10) Tribal members fishing pursuant to this agreement may employ only members of the Tribes, while exercising their treaty fishing rights.

(11) All fish numbers referred to in this agreement are adult fish.

(12) The sharing formulas contained herein for determining the treaty fishery share refer to those fish caught in the Columbia River below McNary Dam and any other inland off-reservation catch placed in commercial channels.

Except as provided in subparagraph 5 under Spring Chinook, neither treaty nor nontreaty non-commercial harvest in tributaries, or in the mainstem Columbia River above McNary Dam, shall be considered in the sharing formulas contained herein.

(13) Upon thirty days' written notice by any party, after five years from date, this comprehensive plan may be withdrawn or may be renegotiated to assure that the terms set forth represent current facts, court decisions, and laws.

Fish Management Plans

A fish management plan has been adopted for those species of importance to assure future conservation of the resource and equitable sharing of the harvest between treaty Indians and nontreaty users. The formulas represent Available Fish for harvest and may not reflect total catch if fishing effort is inadequate to harvest all available fish. All runs of fish described in this plan are those originating in the area of the Columbia River or its tributaries above Bonneville Dam.

Fall Chinook Salmon

The Columbia River fall chinook shall be managed under the following plan:

(1) Run size shall be determined by the number of fish entering the Columbia River which are destined to pass Bonneville Dam.

(2) Escapement of 100,000 fish above Bonneville Dam shall he subtracted from total in-river run size.

(3) Additional fish above escapement are available for harvest and shall be shared 60% by treaty fishermen and 40% by nontreaty fishermen.

(4) The states' goal is to manage the fisheries to provide and maintain a minimum average harvestable run size of 200,000 upriver fall chinook to the Columbia River.

(5) The 60% treaty share shall include mainstem ceremonial, subsistence, and commercial harvest as allocated by the Indian tribes. The 40% nontreaty share shall include in-river commercial and sport harvest as allocated by the appropriate agencies.

Spring Chinook

The Columbia River spring chinook shall be managed under the following plan:

(1) Run size shall be determined by the number of fish entering the Columbia River destined to pass Bonneville Dam.

(2) Spawning escapement goals shall be a minimum of 120,000 and 30,000 fish above Bonneville and Lower Granite Dams respectively.

(3) The states' goal is to manage the fisheries to provide and maintain a minimum average run size of 250,000 upriver spring chinook to the Columbia River.

(4) Treaty ceremonial and subsistence catch shall have first priority. These fisheries shall not exceed a catch of 2,000 fish on a run size of less than 100,000 fish; 5,000 on run size of between 100,000 and 120,000 fish; and 7,500 fish on a run size of between 120,000 fish and 150,000 fish. Treaty ceremonial and subsistence fishing for spring chinook with gillnets as well as other normal gear may occur, but such gillnet fishing shall be subject to a notification system similar to that presently used for ceremonial fishing. All catches shall be monitored cooperatively for the purpose of ascertaining the amount of the catch.

(5) On a run size of between 120,000 and 150,000 fish passing Bonneville Dam, the nontreaty fisheries are limited to the Snake River system and may harvest fish which are in excess of the 30,000 spawning escapement passing Lower Granite Dam. (Under average river flow conditions, 120,000 fish at Bonneville Dam will generally provide 30,000 fish at Lower Granite Dam and 150,000 fish at Bonneville Dam will generally provide 37,500 fish at Lower Granite Dam.)

(6) On a run size of more than 150,000 fish passing Bonneville Dam, all allocations as provided for in items 4 and 5 shall occur. All additional fish available for harvest below McNary Dam shall be shared 40 percent for treaty fishermen and 60 percent for nontreaty fishermen. If river passage conditions improve so as to provide more than 40,000 fish at Lower Granite Dam on run sizes of 150,000 fish or less, the 40 percent and 60 percent allocation may occur on a run size of less than 150,000 fish at Bonneville Dam.

Summer Chinook Salmon

Summer chinook salmon runs are precariously low and do not warrant any fishery at the present time, with the exception of a treaty subsistence, ceremonial, and incidental catch not to exceed 2,000 fish during the months of June and July.

The parties agree that if the run size increases a formula for sharing of the available harvest above present escapement goals shall be similar to spring Chinook.

Summer Steelhead

(1) Run size shall be determined by the number of fish entering the Columbia River destined to pass Bonneville Dam.

(2) The escapement goal to spawning grounds above Lower Granite Dam shall be a minimum of 30,000 fish. A run size of 150,000 fish at Bonneville Dam will provide for 30,000 fish at Lower Granite Dam.

(3) The treaty Indian mainstem fishery shall be limited to ceremonial, subsistence and incidental catch to other commercial fisheries. A minimum mesh restriction of 8 inches will be utilized to limit incidental catch.

(4) The Indian tribes recognize the importance of the steelhead stocks to recreational users end agree to forego a target commercial fishery.

Sockeye Salmon

Sockeye salmon runs are precariously low and do not warrant any fishery at the present time, with the exception of a treaty subsistence, ceremonial, and incidental catch not to exceed 2,000 fish.

The parties agree that if the run size increases so as to provide harvestable quantities, such harvest shall be shared equally between treaty and nontreaty fishermen.

The Parties recognize the importance of protecting summer chinook and summer steelhead stocks during the harvest of sockeye salmon. Incidental catch of summer chinook and steelhead shall be minimized by providing appropriate restrictions to the sockeye fishery.

Coho Salmon

Coho stock are in the treaty fishing area simultaneously with other species which currently need protection from fishing effort. Parties agree to use their best efforts to develop methods to maximize coho harvest while protecting those other species.

Shad

Shad runs have been sufficiently large to allow for unlimited harvest. However, because shad fisheries can take stocks of salmon and steelhead that are below harvestable levels, new catch methods shall be pursued particularly by the Indians above Bonneville Dam to assure a sufficient catch of shad while minimizing the catch of other species. If escapement goals and catch formula must he established in the future, the committee shall compile the required data and make recommendations to the managing fisheries agencies.

Sturgeon

The population of sturgeon in the Columbia River appears residual above Bonneville Dam. The parties agree that the Indian tribe shall have a commercial fishery regulated by sound principles of conservation and wise use. A sport harvest may occur simultaneously for sturgeon above Bonneville Dam.

Winter Season

The treaty fishermen shall be allowed a mainstem commercial fishery for any species of fish between February 1, and April 1.

APPENDIX H

Treaties, Compacts, and Related Agencies

1909 Boundary Waters Treaty - U.S. and U.K. (Canada)

This treaty provides for regulation of navigation, control of water use and diversions, control of water pollution, and, creation of the International Joint Commission with jurisdiction over disputes involving boundary waters.

The International Joint Commission was organized in 1911 pursuant to the 1909 treaty, and consists of six members -- three appointed by the President of the United States and three appointed by the Government of Canada. The treaty parties may from time to time refer questions or matters of difference between the parties to the Commission for examination and report or for decision.

In order to insure that the provisions of the Commission's Orders are observed, the Commission has at times found it necessary to provide for the creation of international boards of control. The International Columbia River Board of Control consists of one U. S. and one Canadian member.

Columbia River Treaty – U. S. and Canada

The "Treaty between Canada and the United States of America relating to Cooperative Development of the Water Resources of the Columbia River Basin" was signed in January 1961, and final ratification was concluded in September 1964 following completion of complicated arrangements for power purchase, exchange, and allocation; project coordination; and payment agreements.

Under the Treaty, Canada developed 15.5 million acre-feet of usable storage at Mica, Arrow (Keenleyside), and Duncan dams in British Columbia. Canada is to operate this storage for two purposes: (1) increasing hydroelectric power generation in Canada and the United States, and (2) providing 8.45 million acre-feet for flood control. Under the Treaty option, the United States built Libby Dam on the Kootenai River in Montana, providing nearly five million acre-feet of storage for power and flood control.

For flood control benefits resulting from the first 60 years of Canadian storage operations, the United States paid a total of approximately $64 million in installments at the completion of each Canadian dam.

Under the Treaty, Canada is entitled to one-half of the downstream power benefits, produced in the United States by Canadian storage. Due to a surplus of available power and the need to finance the three Canadian projects, Canada agreed to sell its entitlement to the United States for 30 years. To provide a single purchaser for the Canadian entitlement, a nonprofit corporation known as the Canadian Storage Power Exchange (CSPE) was organized in May 1964. Thirty-seven public and four private utilities are participants in the CSPE purchase. Each pays

a proportionate share of bond interest, amortization, and other expenses in exchange for a proportionate share of the Canadian entitlement. In order to carry out this exchange, each of the participating utilities has entered into an agreement with BPA and CSPE to assign its proportionate share of Canadian entitlement power to BPA in return for guaranteed deliveries of power from BPA's system. Each participant pays a fee to BPA for "wheeling" the power to the point of delivery.

Management of CSPE is vested in an 11-member board of trustees. Members are appointed by 11 of the larger utilities in the Northwest: CSPE issued the bonds necessary to finance the purchase and, in September 1964, a lump sum payment of approximately $254 million was delivered to the Canadian government as payment for the 30-year Canadian entitlement.

A further provision of the treaty requires the United States to account to Canada for downstream benefits at all downstream dams regardless of ownership on a formula which assumes that all dams are operated as though under a single ownership. This requirement applies to 24 dams existing in the Basin in 1964 as well as any new dams built on the main stem Columbia River.. This power-optimization requirement resulted in the Pacific Northwest Coordination Agreement, a formal contract for coordinating seasonal operation of federal, public, and private generating resources in the region. Sixteen agencies and utilities have ratified the agreement which took effect in 1965 and terminates in 2003.

A key aspect of, .the U.S. purchase of the Canadian entitlement power was Congressional approval, in August 1964, of the Pacific Northwest-Southwest Intertie. The Intertie assured that the Canadian power could .be resold to the California market during the early years of the Treaty when the Pacific Northwest did not need the entitlement. Deliveries of Canadian Entitlement power to California will be phased out by April 1983.

Two other entities were created by the Treaty:

Article XIV called for appointment of operating entities representing each of the countries. Canada's entity is British Columbia Hydro and Power Authority. The United States Entity consists of the Administrator of the Bonneville Power Administration (chairman) and the Division Engineer, North Pacific Division, U.S. Army Corps of Engineers. The entities are charged with formulating and carryout the operating arrangements necessary to implement the Treaty.

Article XV established a Permanent Engineering Board consisting of two members appointed by Canada and two by the United States. The Board is empowered to assemble records, prepare annual reports of progress under the Treaty, and investigate and report on matters at the request of either country.

Treaties with Pacific Northwest Indian Tribes 1853-1864.

The United States Constitution provides that treaties made under authority of the United States "shall be the supreme law of the land and the judges in every state shall be bound thereby." U.S. Const. Art. VI, cl. 2. During the period 1853-64, the United States made approximately 14 treaties with Indian tribes of the Pacific Northwest by which these tribes ceded to the United States many square miles of land. Under these treaties, reservation's were established and provisions were made for the Indians to fish both on and off the reservations. The treaties generally provided that the Indians were to have the right to fish upon the reservations and also "at all other usual and accustomed stations in common with citizens of the United States;" (e.g., Treaty with the Walla-Wallas, 1855). Although the various reservations established pursuant to these treaties are now specifically delineated, the "usual and accustomed stations" at which the Indians had previously fished were not specified in the treaties and their locations remain a matter for factual determination. The treaties with the Indian tribes of the Pacific Northwest are as follows:

1. Treaty with Rogue River Indians, 1953, .10 Stat. 1018.
2. Treaty with Cow Creek Band, 1853, 10 Stat. 1027.
3. Treaty with Nisqualli, Puyallup Indians, 1854, 10 Stat. 1132.
4. Treaty with Willamette Indians, 1855, 10 Stat. 1143.
5. Treaty with Dwamish and Suquamish, 1855, 12 Stat. 927.
6. Treaty with S'Klallam et al., 1855, 12 Stat. 933.
7. Treaty with the Makah, 1855, 12 Stat. 939.
8. Treaty with Walla Walla, Cayuse, and Umatilla Tribes, 1855, 12 Stat. 945.
9. Treaty with Yakima, 1855, 12 Stat. 951.
10. Treaties with Nez Perce; 1855; 42 Stat 957; and 1863, 14 Stat. 647.
11. Treaty with. Indians in Middle Oregon, 1855, 12 Stat. 963 (Warm Springs Tribe).
12. Treaty with Quinault et.al., 1855, 12 Stat., 971.
13. Treaty with Flathead Indians, 1855, 12 Stat. 975.
14. Treaty with Klamath and Moadac Tribes and Yahooskin Band of Snake Indians, 1864, 16 Stat. 707.
15. Treaty with Eastern Bank Shoahoni and Bannock, 1867, 15 Stat. 673.

See Appendix G regarding the 1977 court-ordered plan concerning Indian and non-Indian fisheries on Columbia River stocks originating above Bonneville Dam.

The Columbia River Fish Compact, Oregon-Washington (1915)

The Columbia River Fish Compact between the States of Oregon and Washington was ratified by Congress on April 8, 1918, (40 Stat. 515). The compact is set forth is the respective statutes of each state: (ORS 560.010 and RCW 75:40:010.)

This compact text is as follows: "All laws and regulations now existing, or which may be necessary for regulating, protecting, or preserving fish in the waters of the Columbia River or its tributaries, over which Washington and Oregon have concurrent jurisdictions, or any other waters within either state which would affect said concurrent jurisdiction, shall be made, changed, altered, and amended in full or in part, only with the mutual consent and approbation of both states."

Nothing in the compact shall be construed to affect the right of the United States to regulate commerce, or the jurisdiction of the United States over navigable water routes.

Pacific Marine Fisheries Commission Compact (1947)

The Pacific Marine Fisheries Commission Compact, between the States of Alaska, California, Idaho, Oregon, and Washington was negotiated under a congressional Act approved July 24, 1947, (61 Stat. 419) as amended by the Act approved October 9, 1962, (76 Stat. 763). It was ratified by the States of California, Oregon; and, Washington in 1947, the State of Idaho in 1963, and the State of Alaska in 1968. The text of the compact is set forth in RCW 75.40.030.

The purpose of the compact is to promote the better utilization and protection of the Pacific Coast fisheries (marine, shell, and anadromous) and to create the Pacific Marine Fisheries Commission. The Commission's duties include making investgations relating to the conservation and prevention of depletion, waste, and abuse of the fisheries; recommending appropriate legislation; advising state fisheries administrators; and cooperating with state fisheries research agencies. An Advisory Committee consisting of commercial fishing interests is also called for by the compact.

Columbia Interstate Compact (Unperfected)

Congress, by Act of July 16; 1952, (66 Stat. 737) gave its consent to the States of Idaho, Montana, Oregon, Washington, and Wyoming to enter into a compact providing for the equitable diversion and apportionment of the waters of the Columbia River and all its tributaries in the states entering into such compact, upon the condition that one qualified person shall be appointed by the President of the United States as a representative of the United States. This congressional consent was modified to include the States of Nevada and Utah by Act of July 14, 1954, (68 Stat. 468).

A Columbia River Interstate Compact Commission drafted and approved a compact in December 1954 and submitted the compact to the seven state legislatures for ratification. Ratification attempts were made during the 1953, 1957, 1961, 1963, and 1965 legislative sessions, but the legislatures of Oregon and Washington failed to ratify the proposed or revised versions of the compact.

Although legislation enabling compact negotiations and creating the Interstate Compact Commission is still in effect, little interest in renewed negotiations toward a compact has been shown in recent years.

Reference

Pacific Northwest Riper Basins Commission, Columbia-North Pacific Region Comprehensive Framework Study, Appendix III, "Legal and Administrative Background." March 1970.

APPENDIX I

OTHER RELATED PLANNING AND MANAGEMENT ACTIVITIES

This appendix is a discussion of significant ongoing activities related to the planning and management of the Columbia River. Those activities which are discussed below are:

Columbia River Treaty
Pacific Northwest Coordination Agreement
Pacific Northwest River Basins Commission
Corps of Engineers' Columbia River and Tributaries Review Study
Operational Streamflow Forecasting
Columbia River Water Management Group's Committee on Fishery Operations
Corps of Engineers' Environmental Review of Water Withdrawals
Motions for Modification of Mid-Columbia PUD Project Operations
Threatened/Endangered Species Review of Upriver Columbia River Salmon
Comprehensive Plan for Columbia Basin Anadromous Fish

Columbia River Treaty

The Columbia River Treaty between the United States and Canada, formally adopted on September 16, 1964, provided for the construction and cooperative operation of Mica, Arrow, and Duncan dams in Canada, and Libby Dam in the United States. Under the terms of the Treaty each nation has designated an operating entity. The Canadian entity is British Columbia Hydro and Power Authority, while the United States' entity consists of the Administrator of BPA and the North Pacific Division Engineer, U. S. Army Corps of Engineers. The entities have in turn appointed representatives to two committees, the Operating Committee and the Hydrometeorological committee, which are charged with the carrying out of the cooperating arrangements necessary to implement the Treaty.

The Operating Committee meets periodically to coordinate the details of the operation of the Treaty projects and to prepare plans for future operations. The Operating Committee annually prepares four reports which are issued by the entities. For 1978, these were the Assured Operating Plan for Operating Year 1983-1984; the Determination of Downstream Benefits Resulting from Canadian Storage for Operating Year 1983-1984; the Detailed Operating Plan for Operating Year 1978-1979; and the annual report on Operation of Treaty Projects. The operating plans are based on systems analysis studies conducted by the Operating Committee.

The Hydrometeorological Committee meets to coordinate the exchange of hydromet data between the entities, to coordinate forecasting procedure development, and to plan for hydromet automation.

Pacific Northwest Coordination Agreement

This contract, providing for planned electrical power operation among the major generating utilities of the Pacific Northwest, was finalized in August 1964, after a long period of negotiation, and is scheduled to terminate on July 30, 2003. The Agreement provided operation guarantees which insure usability of Columbia River Treaty Storage to the downstream generating plants under certain conditions.

The contract provides procedures for establishing system operating criteria for each succeeding operating year. Normally; the planning process is initiated on February 1 and is largely completed by July. The studies determine the system firm load carrying capability; energy exchanges; schedule of levels that each storage reservoir should follow in order to assure meeting system load and insure refill; a determination of headwater benefit payments and establish rights and obligations of each party for the use of stored water at headwater projects.

Since 1975-76, Canada has exercised its option under the Treaty to base its operation of the Treaty Projects on the Assured Operating Plans (developed six years prior to the actual year of operation) rather than the detailed Operating Plans (developed immediately prior to each operating year). The detailed Operating Plans have required deep drafts of Canadian storage in conflict with Canadian interests. System storage deficits resulting from use of the Assured Operating Plans have been met by deeper drafts in federal storage reservoirs, resulting in energy losses due to reduced plant head. Revisions to the Principles and Procedures for Preparation and Use of Hydroelectric Operating Plans, reflecting the Canadian intent to continue to base operations on the Assured Operating Plan, are nearing completion.

Pacific Northwest River Basins Commission

The PNRBC was created at the request of the governors of Idaho, Montana, Oregon, Washington, and Wyoming by Presidential Executive Order in 1967 under the authority of the Water Resources Planning Act (P.L. 89-80). In addition to the five states, other members of the Commission include the presidentially appointed chairman and 10 federal departments, agencies, and entities. Canada and the Indian tribes participate as nonvoting observers at the chairman's invitation.

The act directs that each such river basin commission shall:

(1) serve as the principal agency for the coordination of Federal, State, interstate, local and non-governmental plans for the development of water and related land resources in its area . . .

(2) prepare and Keep up to date . . . a comprehensive, coordinated, joint plant for Federal, State, interstate, local; and nongovernmental development of water and related resources . . .

(3) recommend long-range schedules of priorities for the collection and analysis of basic data and for investigation, planning, and construction projects; and

(4) foster and undertake such studies of water and related land resources problems in its area . . . as are necessary in the preparation of the plan . . ."

The Commission has completed a number of subregion basin studies and the Columbia-North Pacific Region Comprehensive Framework Study. These efforts contribute to the comprehensive, coordinated, joint plan (CCJP). Other principal contributors to the CCJP are state water plans and management programs and agency studies, plans, and programs.

The CCJP report, which has been titled Water - Today and Tomorrow - A Pacific Northwest Regional Program for Water and Related Resources was adopted in December 1979: Being prepared in conjunction with the CCJP report are annual regional priorities reports. The Commission has adopted work programs oriented toward implementation of CCJP recommendations which, in turn, are oriented toward helping to achieve resolution of critical regional water-related issues. Nearly all of these issues may be treated under the umbrella issue of "How to Achieve and Implement Agreement on the Use and Control of the Waters of the Columbia River System." A major element of this work program is a trade-offs analysis.

Other major Commission activity during 1978 was completion of input to the 1975 National Water Assessment. Work continued on the "Stewards of the River" program, the Regional Recreation Data Program, and "start-up" efforts on the five-year Columbia River Estuary Data Development Program.

Corps of Engineers' Columbia River and Tributaries Review Study

The Columbia River and Tributaries (CR&T) review study is being conducted by the Corps of Engineers in response to requests by Congress for a review of previous reports and development plans for the Columbia River in light of: recent physical and economic changes in the region. This review focuses on system-wide development plans for the Columbia River and its tributaries and will update and extend plans submitted to the Congress and published May 10, 1962; as House Document 403, 87th Congress, Second Session. Requested studies are to be of detailed feasibility scope in order that specific recommendations maybe transmitted to Congress for authorization and subsequent implementation.

This study is emphasizing two major areas: (a) a review of project and system operations and refinement of definite project and system operations criteria; and (b) analysis of new development alternatives needed to supplement the existing resource development plans for the basin. The latter areas will include consideration of structural modifications to include additional functions, nonstructural programs relating to areas such as flood control and recreation, and possible new project development.

Some of the major activities completed include: An inventory of problems and areas of concern, system descriptions for the mid-1970s and mid-1980s levels of river development, an inventory of riparian wildlife habitat, an assessment of the impact that future irrigation development and alternative minimum instream flow levels would have on the existing use and operation of the Columbia River system, and a reconnaissance inventory and evaluation of potential pumped-storage sites in the basin. The study has also completed the following feasibility reports: (1) McNary Second Powerhouse; (2) Yakima River at Union Gap Flood Control; (3) Bonneville Lock Replacement; (4) adding power at Lucky Peak Dam, .and (5).adding power at the Libby Reregulation Dam.

Some of the major activities underway at this time include the development of a mid-1980s Systems Plan for the Columbia River, evaluation of the adequacy of the Columbia River storage system, a review of the feasibility and desirability of future hydropower development, the adequacy of the existing Lower Columbia River levees, and a recreational needs assessment for the Columbia and Lower Snake rivers. Detailed interim project reports currently underway include: the feasibility of expanding the hydropower generating capacity at Chief Joseph Dam beyond 27 units; the feasibility of constructing a pumped-storage project at Omak Lake; the feasibility of providing flood protection to the cities of Richland and West Richland, Washington, located along the Yakima River; and a review of the Willamette Basin projects to determine the feasibility of adding new or additional power to these projects.

The study is being actively coordinated with federal, state, and local agencies, citizens' groups, and the general public. Overall coordination is being maintained with the Pacific Northwest River Basins Commission.

Operational Streamflow Forecasting

The complex operation of the Columbia River reservoir system and the commonality in responsibilities of the various federal agencies have created a need for cooperation and coordination. The Columbia River Forecasting Service (CRFS), in which the National Weather Service (NWS), USCE, and BPA participate, is responsible for coordination of both daily and seasonal operational forecasts. The overall goal of the CRFS is to pool certain resources of these three agencies in the interest of improving streamflow forecasting methods in the Pacific Northwest Region, to avoid duplication of forecasts, and to increase the efficiency of operation.

The NWS River Forecast Center provides routine 365-day, l2-hour (0600-1800 hrs.) river surveillance and during wintertime potential flood conditions operates round the clock. The River Forecast Center prepares forecasts of river stage and discharge for the coastal basins of Oregon and Washington, the Great Basin, and the Columbia River Basin streams. These forecasts of, gauge height and discharge are issued to the public via the NWS River District Offices in Portland, Oregon; Seattle, Washington; Boise, Idaho; and Great Falls, Montana.

Columbia River Water Management Group's (CRWMG) Committee on Fishery Operations (COFO)

This committee, which was established in 1975, includes representatives of the Bonneville Power Administration, Corps of Engineers, Bureau of Reclamation, public and private utilities, and federal and state fisheries agencies. During the latter part of 1978, this committee worked extensively on a plan for passing juvenile salmon and steelhead through the Columbia and Lower Snake rivers during the 1979 migration season. The committee was unable to reach an agreement which is fully acceptable to all parties. However, a compromise agreement has been developed and the project operations have stated that they will make a concerted effort to comply.

Corps of Engineers' Environmental Review of Water Withdrawals

In the fall of 1978, the Corps initiated this two-year study under its authorities relating to the Section 10 (33 U.S.C. 403) and Section 404 (P.L. 92-500) permit programs.

The environmental review will gather baseline information and will evaluate effects associated with several levels of consumptive withdrawals of water from the following rivers:

1. Columbia, from the estuary to the Canadian border
2. Snake, from the mouth to Jackson Lake
3. Yakima
4. Umatilla
5. Okanogan
6. South Fork Boise
7. Salmon, Clayton to the North Fork
8. Henry's Fork

Evaluations will be conducted for historical and current conditions and several future water withdrawal scenarios.

From a State of Washington perspective, it appears to this department that the Columbia River flow as modified by power and flood control operation rules is being used as the base for displaying the effects of withdrawals of water. Also, the State of Washington is concerned with the inclusion of the Okanogan and Yakima rivers in this study.

The following is an overview of the basic steps in this study and the schedule for each:

	Completion Date
Collect baseline information	9/79
Develop water withdrawal scenarios	12/79
Assess effects of water withdrawal	10/80

Motions for Modification of Mid-Columbia PUD Project Operations

In December 1978, the Washington State departments of Fisheries and Game moved the Federal Energy Regulatory Commission for order directing the mid-Columbia PUDs to provide specified flows and spills for the protection of migrating salmon and steelhead juveniles. See Appendix J and K for draft settlement agreements related to these motions.

Threatened/Endangered Species Review of Upriver Columbia River Salmon

In October 1978, the National Marine Fisheries Service and U.S. Fish and Wildlife Service formally began reviewing salmon and steelhead stock originating in the Columbia Basin above McNary Dam for possible inclusion on the national list of threatened or endangered species. Current efforts are directed toward (1) defining "species" and "population" as applied to salmon and steelhead as related to scientific and legislative definitions; (2) determining the biological threshold at which a population of salmon or steelhead would become threatened or endangered with extinction; and (3) determining the extent to which such a population could accept artificial propagation, and if and how artificial propagation would affect the threshold established in (2). If appropriate, based on these determinations, a provisional identification of threatened or endangered species could occur during the late summer of 1980, according to the current schedule.

Comprehensive Plan for Columbia Basin Anadromous Fish

The Columbia River Fisheries Council, composed of representatives of Columbia River Basin state, federal and Indian fishery, agencies,* will soon complete a draft long-term comprehensive plan for production and management of Columbia River salmon and steelhead.

This plan is being prepared by a core planning team under CRFC direction. State, federal and Indian fisheries specialists are providing technical support. A citizen advisory committee composed of representatives of all user groups is providing hands-on input throughout the planning process.

The long-term comprehensive plan is designed to serve five basic, interrelated purposes:

> Establish long-term salmon and steelhead production goals fog the entire Columbia River Basin.
>
> Devise strategies for improved coordination among federal, state and Indian fishery interests.

*Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, Idaho Fish and Game Department, U.S. Fish and Wildlife Service, National Marine Fisheries Service.

Improve the effectiveness of agencies charged with the responsibility for fishery resources.

Facilitate constructive public involvement in salmon and steelhead and related resource decision making processes.

Provide guidance and input to nonfishery interests whose planning and operational programs affect or portend to affect anadromous salmon and steelhead.

The long-term planning effort was funded by the Pacific Northwest Regional Commission to chart a coordinated, regional course toward restoring valuably salmon and steelhead runs and the economic dependent upon them. The preliminary draft plan is expected to be ready for public review and comment in late June of this year.

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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Charles B Curtis, Chairman;
Georgiana Sheldon and Matthew Holden, Jr.

Public Utility, District No. 2 of Grant County, Washington	)	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington	)	Projects Nos. 943 and 2145
Public Utility District No. 1 of Douglas County, Washington	)	Project No. 2149
State of Washington Department of Fisheries	)	
v.	)	Docket No. E-9569
Public Utility District No. 2 of Grant County, Washington	)	

ORDER APPROVING UNCONTESTED OFFER OF SETTLEMENT

(Issued October 15, 1979)

By order dated March 7, 1979, we established a hearing to investigate whether the operation of certain projects listed in the above-captioned proceeding should be modified in the interest of protecting the fishery resources of the Columbia River. An issue to be considered during the hearing was whether the current minimum flow at the Priest Rapids Project No. 2114 should be increased for the purpose of protecting the chinook salmon spawning and incubation areas downstream from the dam.

On September 19, 1979, the Presiding Administrative Law Judge certified to the Commission an offer of settlement submitted by the Public Utility District No. 2 of Grant County, Washington (Grant), licensee for the Priest Rapids Project. In the certification, the Judge concluded that the offer of settlement was uncontested and that no unsettled material issues of fact existed.

APPENDIX A TO ORDER APPROVING
UNCONTESTED OFFER OF
SETTLEMENT

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility, District No. 2 of Grant County, Washington	)	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington	)	Projects Nos. 943 and 2145
Public Utility District No. 1 of Douglas County, Washington	)	Project No. 2149
State of Washington Department of Fisheries	)	
vs.	)	Docket No. E-9569
Public Utility District No. 2 of Grant County, Washington	)	

UNDERSTANDING

1. On March 7, 1979, the Commission issued an order which provided for an investigation and a hearing regarding various petitions filed in these dockets seeking certain minimum flow releases from Project Nos. 2114, 943, 2145, and 2149.

2. During the week of June 25, 1979, the parties engaged in negotiations for the purpose of reaching a settlement with respect to the various issues raised in those petitions regarding the flow requirements of fall chinook salmon spawning in the Hanford reach downstream from Priest Rapids Dam. This has been commonly referred to as the Vernita Bar Phase of this proceeding and covers the period from October 15 until approximately April 30. As a result of those negotiations the parties have reached the Agreement set forth below.

3. The Agreement reached and the approval of this Agreement by either the Commission or the Presiding Administrative Law Judge shall not constitute an approval of or a precedent regarding any principle or issue in this or any other proceeding.

Comments on the offer of settlement were submitted by the National Marine Fisheries Service (NMFS), staff, and the Public Utility District No. l of Chelan County, Washington (Chelan). NMFS and staff recommended certain minor changes to the offer of settlement. Chelan stated that it did not oppose the recommended chances. Grant has interposed no objection to those chances either.

According to the offer of settlement, Grant County would conduct a four-year study to investigate the effect of varying flow regimes on the spawning incubation, and emergence of fall chinook in the area of Vernita Bar, downstream from Priest Rapids Dam. This study -- which is to begin October 15, 1979 -- requires different flow regimes for each of the first two years of the study. During the remaining two years, the different flow regimes would be implemented but are subject to change if two parties seek a modification via settlement proceedings. Upon completion of the study any party may petition the Presiding Judge or the Commission for the issuance of an order establishing further procedural dates in this portion of the proceeding.

The offer of settlement will narrow the issues remaining before the Presiding Judge. We conclude that the offer of settlement, with the minor modifications proposed by the staff and NMFS, is reasonable and in the public interest in carrying out the provisions of the Federal Power Act and should be approved. A cony of the approved offer of settlement, as modified, is attached as Appendix A.

The Commission orders:

(A) The offer of settlement certified to the Commission by the Presiding Administrative Law Judge on September 19, 1979, as modified in accordance with the comments of the Commission's staff and the National Marine Fisheries Service, is approved.

(B) The Commission's approval of this settlement shall not constitute approval of or precedent regarding any principle or issue in this proceeding.

By the Commission.
(S E A L)

Kenneth F. Plumb,
Secretary.

II.

AGREEMENT

1. A four year study shall be conducted to investigate the effect of varying flow regimes on the spawning, incubation, and emergence of fall chinook salmon in the area of Vernita bar, downstream from Priest Rapids Dam. As long as the upstream federal projects and reservoirs are operated so as not to prevent Priest Rapids Dam from releasing the following flows, the following flows shall be maintained for two of the four years:

a. During the period of spawning, from October 15 to November 30, a minimum flow of 50,000 cfs (except as hereafter specified, all flows shall be as measured at the USGS gauge downstream from Priest Rapids Dam) shall be maintained from Priest Rapids dam. On two weekends (and a third if agreed necessary by Grant County and the Fisheries Agencies) during the spawning, the flows shall be reduced to 36,000 cfs for up to 8 hours per day in order to provide access to Vernita Bar for a ground survey of the redds and for the performance of studies. During each night of the week, except on days when flows are reduced to provide access to Vernita Bar, flows shall be reduced to 50,000 cfs for approximately 6 hours.

b. Except as provided in paragraph 3, during the period of incubation until the beginning of emergence, as hereinafter defined, a minimum flow of 50,000 cfs shall be maintained from Priest Rapids Dam for not less that 16 hours in any 24-hour period, as measured from 12:00 noon until 12:00 noon. For up to 8 hours in that 21-hour period but for no more than 8 continuous hours at any one time, flows may be reduced to not less than 36,000 cfs, as determined by power requirements.

The period of emergence shall be calculated, beginning with the date on which are formed 10 percent of the redds located on Vernita Bar above the flow level of 36,000 cfs, plus the number of days required to accumulate 1200 thermal units.

A thermal unit is defined as one degree fahrenheit above 32 for 24 hours, beginning with 12 midnight to 12 midnight. Thermal units shall be estimated by averaging the daily minimum and maximum water temperatures. To the extent possible, the beginning of emergence shall be confirmed by field observations.

c. During the period of emergence, an instantaneous minimum flow of 50,000 cfs shall be maintained.

d. After the completion of emergence, the minimum flow specified in the license for Project 2114 shall obtain. The completion of emergence shall be calculated by identifying the date when the last spawning occurred and adding to that date the number of days required to accumulate 1800 thermal units for the redds.

2. As long as the upstream federal projects and reservoirs are operated so as not to prevent Priest Rapids Dam from releasing the following flows, and except as provided in paragraph 3, the following flows shall be maintained in the remaining two years:

a. During the period of spawning; as defined in paragraph 1(a), a minimum flow of 50,000 cfs shall be maintained for not less than 16 hours in a 21-hour period, as measured from 12:00 noon to 12:00 noon. For up to 8 hours in that 24-hour period but for no more than 8 continuous hours at any one time, flows may be reduced to not less than 36,000 cfs; as determined by power, requirements. During each weekday night flows shall be reduced to approximately 36,000 cfs for not less than 6 hours. On the weekends, flows may be reduced to 36;000 cfs for up to 8 hours per day to provide access to Vernita Bar for ground surveys of the redds and for the performance of studies.

b. Except as provided in paragraph 3, the flows during: the period of incubation shall be maintained as described in paragraph 1(b).

c. The flows during the period of emergence shall be maintained as described in paragraph 1(c).

d. The flows following the period of emergence, shall be maintained as described in paragraph 1(d).

3. As long as the upstream federal projects and reservoirs are operated so as not to prevent Priest Rapids Dam from releasing the following flows, the minimum flows during the period of incubation shall be increased to 50,000 cfs for 24-hours per day if:

a.. The distribution of redds on Vernita Bar, as measured by fixed wing aerial counts and the differential rate of mortality for eggs and/or alevins above the 36,000 cfs flow level (as described in Appendix B) indicate a 15 percent increase in mortality of eggs and/or alevins an Vernita Bar as a result of the flows described in Paragraphs l(b) and 2(b).

b. During the first year of study when the minimum flows in paragraph 1(a) apply, the redds counted for the purpose of paragraph 3(a) shall not include those redds located above the elevations of Vernita Bar corresponding to a depth of water 1 foot above the flow level of 50,000 cfs.

c. A requirement to increase flows in accordance with this paragraph; following a spawning season in which the flows described in paragraph l(a) applied, shall not preclude the Licensee of Project 2114 from maintaining in subsequent years the flows described in paragraph 2(a) and conducting the studies provided for by paragraph 5.

4. In 1979, the flow to be maintained during the period of spawning shall be determined by reference to the calculated energy content curve utilized under the Pacific Northwest Coordination Agreement. If on October 8, 1979 the measured energy content of all of the storage reservoirs object to the Pacific Northwest Coordination Agreement is more than 8,000 megawatt-months below the calculated energy content curve, then the minimum flows in paragraph 2(a) will apply. The minimum flows described in paragraphs l(a) and 2(a)will apply in alternate years; provided however that if the flows in 1979 are maintained according to paragraph l(a); then in 1981 the flow to be maintained shall be determined by reference to the calculated energy content curve as described above. Should the minimum flows described in paragraph 2(b) be selected in 1981, the flows in 1982 will be maintained according the paragraph 2(a).

5. During the course of the four year period, the studies described in Appendix A shall be conducted by Grant County PUD.

6. Specific study plans shall be coordinated with designated representatives of the Public Utility Districts, the Washington Department of Fisheries, the National Marine Fisheries Service and the Oregon Fish and Wildlife Commission. The parties responsible for each such study plan will use their best efforts to develop them well in advance of the date of study and circulate them to all parties and FERC Staff for review and comment.

7. The agencies of the State of Washington who are parties to this proceeding shall provide such permits and authorizations as are required to perform the studies described in appendices A and B. The agencies also shall support Grant PUD in obtaining such permits and authorizations as are required from other state and federal agencies to perform those studies.

8. Grant PUD shall use its best efforts to publish a final report of each year's study, as described in Appendix A, by July 1 of the year following each spawning season. Reports of any field study conducted by any of the parties of this proceedings with respect to the Vernita Bar phase of this proceedings with respect to the Vernita Bar phase of this proceeding shall be made available to the other parties and staff for review and comment before publication or general circulation. Comments submitted shall be accepted in the report, or incorporated as an appendix to the report. All reports and compilations of data shall be filed with the Federal Energy Regulatory Commission and transmitted to all parties and the staff upon request.

9. The hearing scheduled for August 6, 1979, shall be cancelled. On or after July 1, 1981, any two parties to this proceeding (including the FERC Staff) may, on 30 days written notice to the other parties, convene a settlement conference for the purpose of seeking modifications to this Agreement, provided: (1) that each of the flow regimes described in paragraphs 1 and 2 have been implemented and (2) that the studies referred to in paragraph 5 have been conducted for those years as provided in this Agreement. Upon the completion of the term of study provided for by this Agreement or by the Agreement as it may be amended, any party may petition the Presiding Judge or the Commission for the issuance of an order establishing further procedural dates in this portion of the proceeding. In the event that there are modifications to any of the projects subject to this which will impair the scientific validity of the studies described in Appendices A or B, any party to this proceeding may petition the Presiding Judge for such modifications to the studies or to the flows subject to this agreement as may be necessary to ensure the conduct of valid studies and the acquisition of reliable data.

APPENDIX A

PROPOSED STUDIES ON VERNITA BAR
1979 - 82

	Study	Timing
A.	Distribution of redds at various bar elevations over time.	
	1. Weekly aerial photos.	1979, 80,
	2. Weekly fixed-wing count.	81, 82
	3. Peak week helicopter count.	
	4. SCUBA diving to define outer boundary and density of spawning in deep water.	
B.	Surface water velocities at 3 transects and various bar elevations within 1-foot of bottom, channel center to 70,000 cfs water level -- at flows 36,000 cfs to maximum.	1979
C.	Intragravel environment	
	1. Sample gravel composition with McNeil and freeze techniques on 3 transects in zones from sub-36,000 cfs to 70,000 cfs. Samples will be extracted from water as deep as methods permit. Deeper areas will be photo evaluated.	1979
	2. Assess gravel permeabilities with Mark VI standpipes in various bar elevations.	1979
	3. Measure intragravel water elevations, dissolved oxygen, temperature and apparent velocity with Mark VI standpipes at bar elevations noted in (1), sequentially in time after dewatering at least twice in fall and once in spring (if flows at latter time are compatible).	1979, 80
D.	Survival of embryos and alevins	1979, 80,
	1. Place fall chinook embryos in containers in artificially constructed redds. Sample size to be about 500 newly fertilized eggs in each of 4 containers buried in factorial design at bar elevations sub-36,000 cfs to 70,000 cfs levels along 2 transects.	81, 82
	2. Extract one embryo container from the substrate in each cell soon after hatching.	
	3. Excavate about 150 redds just after November 30 to assess presence or absence of embryos. First embryos found constitute adequate indication.	

E. Enhancement studies — 1979, 80---

1. Scarification.
   a. Select 3 pairs of plots of not more than 5000 ft. square each, at least 500 yards below Vernita Bar in areas without evidence of prior spawning. Evaluate permeability.
   b. Scarify and windrow substrate on one plot in each pair, leaving the adjacent upstream plot unaltered. Scarification to be diver directed just above and below wetted stream margin at minimum flows.
   c. Use aerial and ground counts of redds on altered plots and controls to evaluate efficacy.
2. Contribution of hatchery fish.
   a. Evaluate contribution of hatchery fish to the spawning population on and near Vernita Bar and to volunteers entering Priest Rapids channel. WDF to undertake study. If contribution of hatchery fish is significant, WDF shall pursue methods of imprinting and attraction of fish of hatchery origin so that these fish will enter hatchery/channel attraction water voluntarily. — 1979---
3. Intragravel irrigation.
   a. To be considered after 1979 spawning studies yield data on intragravel environment. — 1980---
   b. Test of a system and its impact on intragravel water will be conducted in summer of 1980.

APPENDIX B

Paired groups of incubation containers will be placed at 36,000 and 50,000 cfs levels to provide data for triggering a possible increase in minimum flow from 36,000 to 50,000 during the incubation period. Containers will be placed within boundaries of natural redds but outside of egg pockets to minimum adult excavation of boxes.

Embryos should be placed about November 4, depending upon egg availability. There should be 40 pairs of box placements along the bar (total of 80 cells), each cell to have 2 boxes. Placement will be just below the 36,000 and just below the 50,000 cfs levels. There shall be 300 embryos per box, depending on availability.

Control groups will be placed in the Priest Rapids hatchery. All calculations of mortality at each flow level will be corrected by control mortality.

One box in each cell will be pulled for mortality check just before hatching; a second box just after hatching. Mean mortality at each flow level will be calculated with a paired, one-tailed student's test using a probability level of 0.10.

APPENDIX K
Spring Migration 5 year study

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility, District No. 2 of Grant County, Washington	)	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington	)	Projects Nos. 943 and 2145
Public Utility District No. 1 of Douglas County, Washington	)	Project No. 2149
and		
State of Washington Department of Fisheries	)	Docket No. E-9569
vs		
Public Utility District No. 2 of Grant County, Washington	)	

OFFER OF SETTLEMENT

UNDERSTANDINGS

1. On March 7, 1979, the Commission issued an order which provided for an investigation and a hearing regarding various petitions filed in these dockets seeking certain minimum flow releases and spills from Projects Nos. 2114, 943, 2145, and 2149.

2. During the week of October 22, 1979, the parties engaged in negotiations for the purpose of reaching a settlement with regard to the various issues raised in these petitions regarding the flow requirements, spill and project operations for the downstream migration of juvenile salmonids. This has been commonly referred to as the "spring migration" phase, and covers the period from approximately April 15 through June 15. As a result of these negotiations, the parties have reached the Agreement set forth below.

3. The agreement reached and the approval of this agreement by either the Commission or the Presiding Administrative Law Judge shall not constitute an approval of or a precedent regarding any principle or issue in this or any other proceeding.

AGREEMENT

1. A five-year study program shall be conducted by the Public Utility Districts to investigate the effect of the projects and their operation on the downstream migration of juvenile salmonids, the methods of improving protection of and increasing semi-natural and artificial production of salmonids from the Mid-Columbia River. The studies to be performed in 1980 and possible studies for subsequent years are set out in Appendix A. The obligation to conduct the tests is subject to the availability of suitable and adequate numbers of test fish to be provided by the fisheries agencies.

The studies to be conducted in years following 1980, the priority of studies in yielding data material to resolution of the issues before the Commission in this proceeding and their experimental design will be determined by a majority of the Studies Committee composed of three biologists representing all other parties. If there is not agreement on either the studies to be conducted or their design, then a decision on these questions will be made by a biologist who shall be acceptable to a majority of the Studies Committee's recommendations, including recommendations to perform studies requiring expenditures in excess of the annual budgets referred to below, shall be submitted in writing to the PUDs at least annually, and not lager than November 15. The Studies committee or its designee(s) may review bids for the performance of studies and make recommendations to the PUDs on award of those contracts.

The cost of studies will be shared by the PUDs in such proportion or amounts as they shall agree among themselves, and the costs of study design, implementation and analysis shall not exceed $500,000 annually (1979 dollars), unless authorized by the Public Utility Districts. The cost limitation of $500,000 does not include operation and maintenance costs or capital expenditures for production facilities. The Studies Committee may recommend studies pertaining to reasonable structural changes as may be necessary for the installation and testing of prototype bypass systems, but may not recommend such installation for at least two years. The PUDs will consider recommendations by the Studies Committee for studies requiring expenditures in excess of $500,000 per year, and will authorize those studies that are likely to yield data material to resolution of the issues

before the Commission in this proceeding and if prudent budgetary constraints permit. All parties to the proceeding, including staff, will be given a reasonable opportunity each year to review and comment upon specific study plans prior to their implementation.

The PUDs' agreement to study and test prototype by-pass systems does not constitute agreement that such by-pass systems are an appropriate long-term solution for protection of the fishery resource on the Mid-Columbia River.

2. As long as operation of the upstream federal projects and reservoirs does not prevent it, the daily average minimum flows to be maintained at each dam during the term of the studies shall be those determined in accordance with the following schedule.

	Apr. 1 Apr. 15	Apr. 16 Apr. 25	Apr. 26 Apr. 30	May 1 May 31	June 1 June 15
Wells	50,000	60,000	100,000	115,000	110,000
Rock Reach	50,000	60,000	100,000	115,000	110,000
Rock Island	60,000	60,000	110,000	130,000	110,000
Wanapum	60,000	60,000	110,000	130,000	110,000
Priest Rapids	60,000	60,000	110,000	130,000	110,000

3. Spill.

A. Period. The period for spill provided herein at each of the dams will begin the following dates, and will continue for 30 days or until approximately 80% of the migrating juveniles have passed the dams, whichever is sooner. When 80% of the migrating juveniles has passed the dam will be determined by a majority of the Designated Representatives or, in the absence of a majority within a reasonable time, by the Studies Coordinator:

Project	Date
Wells	April 15
Rocky Reach	April 25
Rock Island	April 25
Wanapum	May 1
Priest Rapids	May 1

B. Amount. The amount of water to be made available for spill shall not exceed on an annual basis the amounts determined for each dam by reference to Appendix B, lines 1 and 2.

C. Rock Island. When the main units of the first powerhouse are not in operation, the amount of water available for spill at Rock Island dam shall be reduced proportionately to the amount of reduction in dam-related mortality (as discussed below) from the Rock Island bulb turbines as compared with Kaplan turbines in use at projects in the bulb turbine mortality test conducted at Rock Island during 1979 and any previously published turbine mortality data for projects in the Columbia River basin. The comparative review of test data will be accomplished by an Ad Hoc committee composed of two representatives of the fishery agencies (Charles Junge, Wesley Ebel), two representatives of the Public Utility Districts (Dan McKenzie, Donald Chapman), and one independent representative (Douglas Chapman). The Ad Hoc Committee shall review the reliability of the results of the tests, and shall use such results as are found to be reliable by a majority of the Committee. As determined by a majority of the Ad Hoc Committee, the amount of water to be made available for spill in connection with operation of the second powerhouse shall be calculated by multiplying the ratio of all mortalities at Rock Island that are affected by spill to all mortalities at other dams in the Columbia River basin that are affected by spill by the amount of water otherwise determined to be available in accordance with Paragraph 3B. If the majority of the Ad Hoc Committee determines that a mortality, such as forebay or tailrace mortality, is affected by spill but was not measured in the Rock Island Test or the tests conducted at other dams in the Columbia river Basin, then a majority of the Ad Hoc Committee shall rely on its best estimate of that mortality in calculating the foregoing ratio. Use of the mortality data from other dams does not imply its reliability or acceptance for any other purpose.

During the period when one or more of the main units of the first powerhouse is in operation, spill shall be accomplished from Gate 1 (at a daily average rate of 2000 cfs during the period of spill and an instantaneous minimum flow of 1000 cfs) in accordance with Paragraph 3.D. The amount of water to be made available for spill in connection with operation of the first powerhouse shall be in addition to the amount of water made available for spill in connection with operation of the second powerhouse, provided that the total powerhouse will be used for peak load

amount of spill shall not exceed that determined in accordance with paragraph 3.B: This assumes that the first powerhouse will be used for peak load generation. In the event, that its use is shifted from peak to base load generation, then a majority of the Ad Hoc Committee may make appropriate adjustments to the amount of spill to be made from Rock Island dam, up to the amounts otherwise provided for in Appendix B. If an emergency condition exists, the decision shall be made by the Designated Representatives or, in the absence of a majority within a reasonable period of time, by the Studies Coordinator.

D. Use of Spill. Water shall be spilled up to the amounts determined in accordance with Paragraph 3.B. and 3.C. above, as it is required to effectively move fish safely past the dams. The amount, timing of commencement and duration of spill required to move fish when they are present will be determined on a continuing basis by a majority of the Designated Representatives. If a majority of the Designated Representatives cannot be contacted within a reasonable amount of time, the decisions to begin and terminate spill; and the decision on the amount of spill to be accomplished will be made by the Studies Coordinator; as described below at Paragraph 5, or by his designee, at each dam. Unless a greater amount of spill is authorized as described below the amount of spill available daily will be limited to 10% of the daily average flow. During the period of peak migration and on written notice of not less than three working days to the Licensee by a majority of the Designated Representatives (or by the Studies Coordinator when a majority of the Designated Representatives cannot be contacted for their approval within a reasonable time), the amount of spill may be increased to not more then 20% of the daily average flow. Consistent with project design; spill may be directed by the Designated Representatives (or the Studies Coordinator when a majority of the Designated Representatives cannot be contacted for their approval within a reasonable period of time) to be made from surface spill facilities.

E. Supplemental Spill. If at the conclusion of the 30-day spill period provided for in Paragraph 3.A 80% of the run has not passed a dam, then supplemental spill shall be available at that dam. The amount of supplemental spill shall be determined by the election of either (a) until 80% of the run has passed the dam, the previously unspilled portion of water provided in Paragraphs 3.B and 3.C, or b) for a period of 15 days or until 80% of the run has passed, whichever is sooner, an amount of water determined in accordance with Appendix B, line 3. If the Designated Representatives elect option (b) for Use at Rock Island Dam, then the amount of water to be made available shall be determined by applying the ratio calculated under Paragraph 3.C to the water volume determined by use of Appendix B, line 3. Use of the supplemental spill shall be in accordance with Paragraph 3 D. If 80% of the migrating juveniles have not passed the dam, and the water provided for in Paragraphs 3 A. and 3.C. has been exhausted by the end of the 30-day period, then the Designated Representatives shall elect option (b). The determination of whether 80% have passed the dam and any election of supplemental spill shall be made not later than the end of the 30-day period provided for in Paragraph 3.A. by a majority of the Designated Representatives or, if a majority is not available within a reasonable period of time, by the Studies Coordinator. This determination and election shall be communicated to the PUDs by written notice and shall include a brief statement of the facts relied upon in making the determination.

4. Hatchery Production. During the term of the studies, the Public Utility Districts shall make available the following hatchery production capacity. During the term of the studies, each PUD shall bear the operation and maintenance expenses associated with the operation at its own facility subject to the reallocation of such expenses among the PUDs by their agreement. Expenses of the fisheries agencies in operation and maintenance which are attributable to the PUDs under this Agreement shall be subject to audit by the PUDs.

Wells Hatchery: 25,000 pounds of capacity for steelhead trout, or equivalent loading of other species.

Turtle Rock/Rocky Reach Annex: 75,000 pounds of capacity for fall chinook salmon, or equivalent loading of other races.

Priest Rapids: In addition to the foregoing, three sections of the Priest Rapids spawning channel shall be converted to rearing facilities according to the plan set forth in the CH2M Hill Mid-Columbia Production Optimization Study. The approximate capacity of this facility when completed shall be 75,000 pounds of fall chinook salmon or equivalent loading of other races. Except as provided below with respect to "Other facilities," and except in accordance with Paragraph 9, this shall be Grant PUD's sole obligation to provide hatchery production or rearing facilities during the 5-year term of this Agreement. Utilization of the Priest Rapids spawning channel also may be subject to any orders entered by the FERC in licensing of additional units for Project No. 2114.

Other facilities. Up to four additional sections of the Priest Rapids spawning channel shall be made available for rearing facilities, developed with reuse of the water from the first three sections of the spawning channel. These sections will be available, at the election of the PUDs, to provide 25,000 additional pounds of capacity for fall chinook or equivalent loading of other races. It also will be available, at the PUDs election, to make up any capacity deficit (as discussed below) for Wells, Turtle Rock/ Rocky Reach or Priest Rapids as those are described above.

In the alternative, to obtain this additional capacity, the PUDs may elect to utilize any existing unused hatchery/rearing capacity in the Columbia River basin. If such election is made; the fisheries agencies agree to make such unused capacity available for the PUDs use, the reasonable operating and maintenance expenses of which production shall be borne by the PUDs. In the event that the additional four sections of the Priest Rapids spawning channel are not capable of producing the additional 25,000 pounds of capacity and/or making up the capacity deficit for Wells, Turtle Rock/ Rocky Reach or Priest Rapids, then it shall be produced in any unused capacity available in the Columbia River basin.

The determination of the species to be produced shall be the decision of the state, tribal and federal fishery agencies following consultation with the PUDs and the FERC Staff.

The production of 200,000 additional pounds as noted above shall neither impair nor reduce the effectiveness of the existing hatchery production commitments of the PUDs. The means for achieving these production increases shall be reviewed in advance by the state, tribal and federal fishery agencies, and annually thereafter. In the event that the loading rate estimates for Wells or Turtle Rock/Rocky Reach hatcheries or the first three sections of the Priest Rapids spawning channel are in error, and it is not physically possible to maintain, with application of the best operation and maintenance practices to optimize production levels, the production capacities defined above and produce healthy fish suitable for release, then additional capacity shall be provided by the PUDs according to the elections stated above. The loading rates used in this evaluation shall not be less than those now used in hatcheries/rearing facilities operated by federal and state fisheries agencies under similar conditions.

Grant PUD shall use its best efforts to complete the improvement of the spawning channel at Priest Rapids for the 1980 brood year; provided, however, that if sufficient numbers of eggs are not available from the fisheries agencies improvements of the spawning channel need be made only to the extent that eggs are available for production. For this purpose, the fisheries agencies will advise Grant PUD as to egg availability by November 1, 1980, and on each November 1 thereafter for that brood year.

5. Subject to the approval of a majority of the Studies Committee, the Public Utility Districts will designate a Studies Coordinator to coordinate the studies to be conducted in accordance with Appendix A. The Studies Coordinator shall coordinate the preparation of reports of the studies conducted.

6. The agencies of the State of Washington which are parties to this proceeding shall provide such permits and authorizations as are required to perform the studies described in Appendix A. The agencies also shall support the Public Utility Districts in obtaining such permits and authorizations as are required from other state and federal agencies to perform those studies.

7. The Public Utility Districts shall use their best efforts to publish a draft report of each year's studies, as described in Appendix A, by October 1 of the year following each migration season. Reports of any field study conducted pursuant to this Agreement by any of the parties to these proceedings with respect to the spring migration in the mid-Columbia shall be made available upon request to the other parties and staff for review and comment before publication or general circulation. Comments to any draft report shall be provided by all parties (and the FERC Staff) not later than 60 days shall following publication of the draft report. A final report shall be prepared within 90 days of the close of the comment period. Comments submitted shall be accepted in the report, or incorporated as an appendix to the report. All reports shall be filed with the federal Energy Regulatory Commission.

8. All parties shall have full access to all data generated by, and in, the course of the studies. Subject to the control and supervision of the Studies Coordinator, all equipment used in the course of the studies shall be subject to inspection and observation by authorized representatives of any of the parties.

9. The Hearing scheduled for January 28; 1980, shall be cancelled. At any time after the completion of the first year of study and the availability of any report of study results, any two parties to this proceeding (including the FERC staff) may, on thirty days' written notice to the other parties, convene a settlement conference for the purpose of seeking, on the basis of the available study results and reports, modifications to the minimum flow or spill requirements described above, provided that a majority of the Studies Committee has recommended it.

Additionally, at the end of three years of study, any two parties may request, upon notice as provided herein, further hatchery production for the remainder of the study term, provided that the incremental mortality (as measured above natural mortality) attributable to the Mid-Columbia River dam system (as measured from the confluence of the Okanogan to the head of McNary pool) is determined, on the basis of data considered by the Studies Committee to have a high level of reliability, to be greater than 62%. The comparison of 62% shall be to the average of the mean mortalities determined from the studies. The natural mortality rate for the Mid-Columbia (as calculated on a per-mile basis) shall be based on the mortality measured in the Hanford reach from the area below Priest Rapids Dam to the head of the McNary pool. For the purpose of this paragraph the system and natural mortality levels shall be determined from at least two years of system mortality studies which are designed to achieve a high degree of reliability, and for which sufficient numbers of test fish are made available by the fisheries agencies. The system mortality tests shall not be conducted during periods in which the flows are substantially greater or less than the flows specified in Paragraph 2.

Additionally, at the end of two years of study, any two parties may request, upon notice as provided herein, such reasonable structural modifications as may be necessary for the installation of prototype by-pass systems at one or more dams, provided that a majority of the Studies Committee has recommended it.

In the event that any two parties believe that the PUDs have unreasonably rejected a recommendation of the Studies Committee to perform studies requiring expenditures in excess of $500,000, they may request a settlement conference.

The notice required by this Paragraph shall include a specific statement of the change requested to the Settlement Agreement and shall briefly describe the reasons for the change. Within ten days after receipt of said notice, any other party may give similar notice as to other changes which should be considered. In the event that the settlement conference is unable to reach a resolution, any two partial may petition the Administrative Law Judge or Commission to modify the requirements of this Agreement on the basis of the available study results and reports developed from the study program provided for by Paragraph 1.

The use of 62% system mortality as the basis for modifying this Agreement is not intended to be a standard for determining ultimate mitigation levels at the conclusion of the study period; nor does it imply that 200,000 pounds of hatchery production constitutes adequate mitigation if system mortality is less than 62%. Neither does this Agreement to provide hatchery production constitute any admission by the PUDs that any mitigation in addition to that now specified in the PUDs' licenses is required of the PUDs; or that the issue of mitigation is before the Commission in this proceeding.

10. On the completion of the term of study provided for by this Agreement, or by the Agreement as it may be amended, any party may petition the Presiding Administrative Law Judge or the Commission for the issuance of an order establishing further procedural dates in this portion of the proceeding.

Appendix A

STUDIES

The following studies will be undertaken in 1980 by the Public Utility Districts. Methods and specific objectives will be developed with open exchange of ideas and information between PUD and agency personnel. Timing and emphasis of post-1980 studies will depend on the recommendations of the Studies Committee and upon results of the 1980 studies.

The constraints on testing and studies include the following:

1. Gravity is to be used as much as possible in bypassing or transporting fish.

2. Hatchery fish to be used in studies which require active movement will be used when smolting and ATPase levels appear acceptable.

3. Insofar as possible, hatchery fish to be marked should be marked at least three weeks in advance of use in tests.

Studies in 1980:

A. Increased Production:

1. ATPase and smolt condition monitoring.
2. Acceleration of spawning (including hormonal and photo period alteration).
3. Preliminary hatchery siting, including literature review and site surveys on the Mid-Columbia River.

B. Survival Augmentation.

1. Evaluation of Rock Island bypass and study feasibility of collection.
2. Development of bypass systems using forebay skimming.
3. Airlift evaluation in gatewells at Rocky Reach (coordinated with John Day).
4. Review feasibility of transport and imprinting.
5. Monitoring of migrant distribution using gatewell dipping and hydroacoustic application.

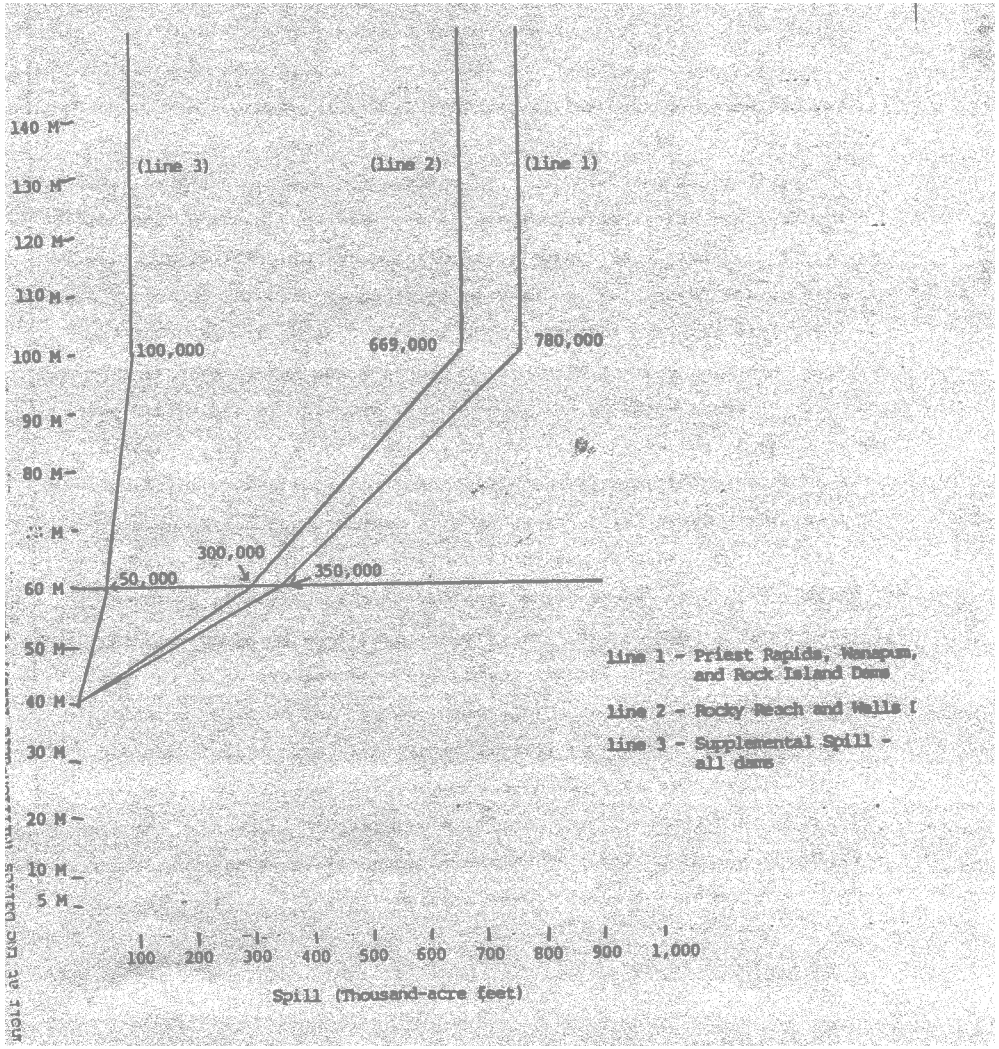
C. Mortality Estimates

1. Wells turbine and spill studies shall have first priority in 1980.
2. Rocky Reach spill and turbine mortality.
3. System-wide and Hanford Reach mortalities.
4. If required and test fish are available, mortalities in connection with Wanapum sluiceway (unless this problem is alleviated through structural modifications at Wanapum).

Possible Studies After 1980 May Include the Following:

1. Continue migrant monitoring and implement hydro-acoustics.
2. Mortality in skim spills.
3. Turbine and Project mortalities at Wanapum, Priest Rapids and first powerhouse Rock Island.
4. Continue studies of spawning acceleration.
5. Initiate transport pilot studies.
6. Effectiveness of split gates - Rock Island.
7. Evaluate collection and bypass at Rock Island.
8. Semi-natural rearing at Priest Rapids and Wells.
9. Annual evaluation of system-wide and Hanford Reach mortality.
10. Habitat, seeding and rearing in tributaries.
11. Data evaluation, coordination and modeling.
12. Predation study leading to management-scale tests.

13. Preliminary hatchery siting, including literature review and site surveys in non-Mid-Columbia areas, if Mid-Columbia River sites are not available.



UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility, District No. 2 of Grant County, Washington	))	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington	))	Projects Nos. 943 and 2145
Public Utility District No. 1 of Douglas County, Washington	))	Project No. 2149
and		
State of Washington Department of Fisheries	))	Docket No. E-9569
v.	)	
Public Utility District No. 2 of Grant County, Washington	))	

RESPONSE OF INTERVENOR STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY TO OFFER OF SETTLEMENT

On behalf of the Intervenor Washington State Department of Ecology (DOE), this is a response to the "Offer of settlement" in Docket No. E-9569. The department received a copy from the National Marine Fishery Service on December 26, 1979; no official copy has yet been received.

The DOE's counsel received notice on December 24, 1979 of the December 14 settlement conference. (See copy attached.) The DOE was therefore unable to participate in the conference. It should be noted that throughout these proceedings there have been great difficulties with provision of adequate notice to the DOE. Although the department has desired to participate fully in the matter, the frequent notice problems have made this most difficult for the agency.

The DOE, as the state's water resource agency, is engaged in the development of water resource management guidelines for the Columbia River. On January 2, 1980 the DOE filed with the Code Reviser's office of the State of Washington a proposed regulation thereon. (Copy enclosed.) That regulation relates to the Instream Resources Protection Program for the mainstem of the Columbia River and is proposed to be adopted pursuant to the authority of Chapter 90.54 RCW, Chapter 90.03 RCW, Chapter 90.22 RCW, and Section VIII, Chapter 21, Laws of 1979, 1st ex. sess. The DOE is the state agency responsible for such matters and is required to consider the interests of the public and other affected agencies, such as those of the state fisheries agency. The department believes the regulation it proposes to adopt reflects a balancing of the various interests presented in the management and protection of instream resources in the Columbia River.

Because of the DOE's developing program for the Columbia River, it has some concern about the offer of settlement. Specifically, the DOE does not wish to be bound or held by the particular management approach followed in the offer of settlement, on a long-term basis. The DOE, however, has provided an accommodation of the study approach set forth in the offer of settlement. See proposed WAC 173-563-050(5). With the understanding that the DOE's long-term management scheme may not necessarily be dictated by the procedures or the results pursuant to the offer of settlement, the department is willing to agree to the approach taken therein. We note, in fact, regarding flow, that the study figures are largely consistent with the flows established by the proposed regulation. See proposed WAC 173-563- 010.

The DOE does have a specific objection to paragraph 6, page 8, offer of settlement. The paragraph seems to indicate that the "party" state agencies will provide necessary permits to enable the study's performance. While the DOE believes this may be proper with respect to certain short-term or "regulatory" type permits; i.e., hydraulic permits or construction permits, the DOE does not believe it can acquiesce in such an agreement with respect to "proprietary" permits which may be needed. Such permits could include water rights permits (see Chapter 90.03 RCW), shoreline management permits (.see Chapter 90.58 RCW), and flood control permits (see Chapter 86.16 RCW). Given the statutory requirements for the processing of permits under the DOE's jurisdiction, we are unable to waive any procedural or substantive requirements in connection with the offer of settlement. Nor are we able to guarantee that such permits, if and when applied for, can be approved conditionally or otherwise, or approved under specific FERC terms. We would accordingly ask that paragraph 6 be redrafted to specify which agencies and which permits will be subject to such agreement. The DOE is not able to agree with the form at present. Within the limits of statutory authority, the department will cooperate with other parties with respect to permits.

Finally, we note that we are uncertain as to the membership of the designated representative committees or ad hoc group for the dams other than Rock Island Dam. The DOE's interests are not adequately represented by the designated representatives, and we would request that consideration be given to granting the department's representative a position on the ad hoc committee, or that, at minimum, notice be given to DOE of committee meetings.

Respectfully submitted,

CHARLES B. ROE, JR.
Senior Assistant Attorney General

LAURA ECKERT
Assistant Attorney General

Attorneys for Intervenor
Department of Ecology

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the office service list compiled by the Secretary in this proceeding in accordance with the requirements of Section 117 of the Rules or Practice and Procedures.

DATED this 15th day of January, 1980.

CHARLES B. ROE , JR.
Senior Assistant Attorney General
Temple of Justice
Olympia, Washington 98504

Attorney for Intervenor
State of Washington
Department of Ecology

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility, District No. 2 of Grant County, Washington	))	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington	))	Projects Nos. 943 and 2145
Public Utility District No. 1 of Douglas County, Washington	))	Project No. 2149
and		
State of Washington Department of Fisheries	))	Docket No. E-9569
v.	)	
Public Utility District No. 2 of Grant County, Washington	))	

ORDER SCHEDULING SETTLEMENT CONFERENCE
(December 10, 1979)

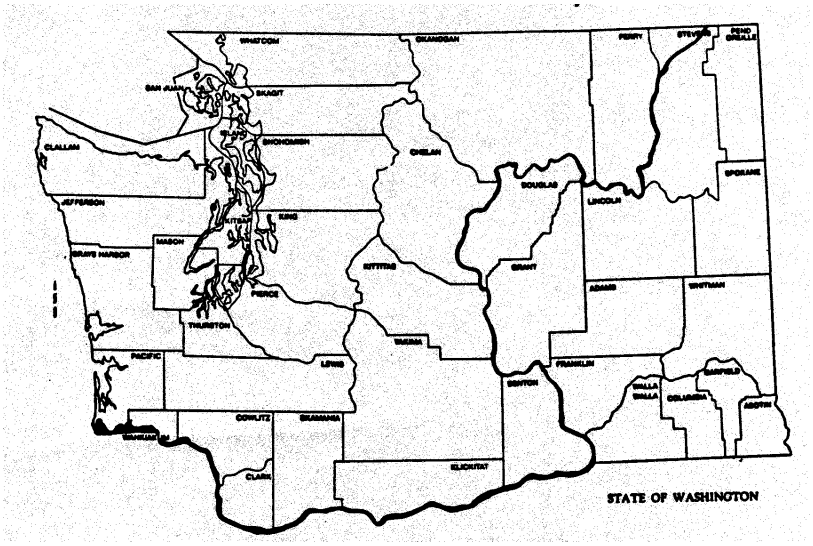
On December 7,.1979, Staff filed a motion requesting that a formal settlement conference be held soon in this proceeding. On the same date, the various Public Utility Districts in this proceeding filed a joint response to an offer of settlement' submitted by petitioners herein, in which they too suggest a settlement conference. It appears from these filings that the parties are well advanced in formulating a settlement but have reached an impasse which should be eliminated: Because it is hoped that a formal conference will facilitate the settlement process, the motion of Staff is granted.

A formal settlement conference is hereby scheduled for December 14, 1979, at 9:00 a.m. in a hearing room of the Federal Energy Regulatory Commission, 825 North Capital Street, N.E., Washington, D.C. 20426. Staff is directed to alert all parties, by telephone or wire, of this impending conference.

Allan C. Lande
Presiding Administrative Low Judge
CD-A-49

Appendix L
Columbia River
Inventory of Shoreline Environment Classifications
and Summary of Permitted Uses:

River Mile	Bank	County
0.0 – 20.5	R	Pacific County
20.5 – 51.5	R	Wahkiakum County
51.5 – 87.0	R	Cowlitz County
87.0 – 129.5	R	Clark County
129.5 - 168:3	R	Skamania County
168.3 - 260.6	R	Klickitat County
260.6 - 395.0	R	Benton County
309.3 - 324.2	L	Walla Walla County
324.2 - 370.0	L	Franklin County
395.0 - 404.5	R	Yakima County
404.5 - 447.5	R	Kittitas County
370.0 - 441.3	L	Grant County - downstream segment
441.3 - 596.3	L	Douglas County
447.5 - 516.6	R	Chelan County
516.6 - 604.0	R	Okanogan County
596.3 - 597.8	L	Grant County - upstream segment
597.8 - 638.9	L	Lincoln County
604.0 - 706.4	R	Ferry County
638.9 – 706.4	L	Stevens County
706.4 – 745.0	R&L	Stevens County



Compiled from Shoreline Master Program in effect February 1979.

Inventory of Permitted Shoreline Uses - Columbia River*

PACIFIC COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
0.0					Mouth of Columbia River
0.0-1.2			X		Fort Canby State Park
1.4					Cape Disappointment Lighthouse
1.2-2.2				X	
2.2-2.4			X		
2.4-2.6		X			
2.6-2.7	X				
2.4-3.1					Ilwaco, Wa.
2.7-2.8	X				
2.8-3.1		X			
3.1-3.2		X			
3.2					Wallacut River
3.2-3.5		X			
3.5-4.2		X			
4.2					Chinook River US 101 Bridge
4.2-5.7			X		
5.7-7.1	X				
7.1-7.2		X			
7.3					Chinook Pt. Fort Columbia State Park
7.2-7.6				X	
7.6-8.1			X		
8.1-9.0		X			
9.0-12.6			X		
12.6-13.2		X			
13.2-19.3			X		
19.3					Grays Point
19.3-20.5			X		
20.5					Pacific, Wahkiakum Co. line, Deep River, Rocky Point

* Designations upland of mean higher high water.

Note: Pacific County has additional environment designations on the tideland areas.

Primary Permitted Uses

Natural: Very low intensity agricultural, aquacultural, and recreational uses are permitted.

Conservancy: Agricultural and aquacultural uses are permitted, provided they do not involve major construction. Forest management operations, mining, residential, and low intensity recreational uses are also permitted.

Rural: Same uses as Conservancy plus commercial uses and marinas are permitted. More intense agricultural and recreational developments are permitted.

Public Access: Improved public access to shoreline areas that can accommodate intensified use without endangering fragile natural areas.

Inventory of Permitted Shoreline Uses - Columbia River

WAHKIAKUM COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
20.5					Wahkiakum, Pacific County line
20.5-21.8	X				
21.8					Grays River
21.8-26.5		X			
23.5					Harrington Point
26.0					Elliot Point
26.5-28.0			X		
28.3					Jim Crow Point
28.0-29.1		X			
29.1-33.5			X		
30.6					Three Tree Point
33.5-35.0	X				
35.0-38.8				X	Hunting Island
37.3					Lower End Cathlamet Channel
38.8-39.8	X				Cathlamet Wa.
39.5					Cathlamet Bridge to Puget Is.
39.8-41.8			X		
41.8-42.4	X				
42.4-43.2			X		
43.2					Nassa Point
43.2-43.9	X				
37.5-38.5		X			Island
37.8-44.2		X			Puget Island left bank (main channel)
44.2-45.8			X		Puget Island left bank (main channel)
37.8-41.8		X			Puget Island right bank
41.8-44.0			X		Puget Island right bank
39.0-41.5		X			Little Island right bank
39.0-41.5		X			Little Island left bank
44.0					Upper end Puget Island (Cathlamet Channel)
45.8					Upper end Puget Island (main channel)
45.8-46.3	X				
45.7					Cape Horn
46.3-47.7			X		
47.7-48.2	X				
48.2-50.5			X		
49.6					Cooper Point, Wa.
50.5-5l.5	X				
51.5					Wahkiakum, Cowlitz County line

Primary Permitted Uses

Natural: Archeological and historic site restoration is permitted. The following uses are permitted as conditional uses: agriculture, aquaculture, docks, marinas, ports, mining, recreation, and single-family residence.

Conservancy: Passive agriculture, forest practice operations, recreation, marinas, mining, and single-family residences are permitted. Feedlots, aquaculture and water-related industries are permitted as conditional uses.

Rural: In addition to the uses permitted in Conservancy, more intense agricultural, aquacultural, and recreational uses are permitted.

Public Access: Access is encouraged where it will not endanger life, property, or private property rights.

Inventory of Permitted Shoreline Uses - Columbia River

COWLITZ COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
51.5					Cowlitz, Wahkiakum Co. line
54.2					Abernathy Point
51.5-56.0			X		
56.0-72.9	X				
58.4-60.0				X	Fisher Island
66.0					Highway 433 Longview, Wa.
68.0					Cowlitz R. and Carroll Channel
68.6-69.2				X	2 islands
69.3-72.5	X				Island
72.9-73.2			X		Kalama River
74.8					Kalama Wa. Port Dock
73.2-87.0	X				
79.5-81.5	X				Martin Island
87.0					Lewis River
87.0					Cowlitz, Clark Co. line

Primary Permitted Uses

Natural: Archeological areas, historic site restoration, and nonmotorized trails are permitted. The following are permitted as conditional uses: aquaculture, commercial development, docks and floating structures, marinas, mining, ports and water-related industries, recreation, single-family residences, and shoreline works and structures.

Conservancy: Passive agriculture, forest management operations, mining, single-family development, utility .systems, and nonmotorized trails are permitted. The following are permitted as conditional uses: feedlots, commercial development, and ports or water-related industries.

Rural: Agriculture, aquaculture, dredging or landfill forest management operations, marinas, mining, ,and low to medium intensity recreational uses are permitted. Ports and water-related industries and commercial development are conditional uses.

Public Access: Develop additional access where it will not endanger life or property nor interfere with private property rights.

Inventory of Permitted Shoreline Uses - Columbia River

CLARK COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
87.0					Clark, Cowlitz County line
87.0					Lewis River
87.0-87.5		X			
87.5					Lake River
87.5-91.6		X			Bachelor Island
91.6-92.8		X			Ridgefield Nat. Wildlife Refuge
99.6					Hewlett Point
100.4					Blarock Landing
92.8-101.9		X			
104.1					Power lines BPA
104.2					Power lines PP&L
105.6					NP-SP&S Railroad bridge
106.5					Interstate 5 Bridge, Vancouver, Wa.
101.9-110.5	X				Industrial area
108.1					Ryan Pt. Kaiser shipyard
111.2					Russell Landing
116.7-118.0			X		Sand Island
118.3-120.7	X				Lady Island
110.5-119.1					
119.8					Gage at Camas, Wa.
120.7					Washougal River
119.1-123.4	X				
123.4-124.7			X		
124.0-128.0			X		Reed Island
124.7-128.5		X			
128.5-129.5			X		
129.5					Clark, Skamania Co. line

Primary Permitted Uses

Conservancy: Agriculture, forest practice operations, roads, railroads, and utilities are permitted. The following are permitted as conditional uses: mining, dredging, ports and industry, commercial residential development, marinas, piers, jetties, breakwaters, landfills, solid waste disposal, aquaculture, historic site modification, and recreation.

Rural: The permitted uses are the same as in Conservancy plus recreation. The conditional uses are the same as Conservancy less recreation.

Public Access: Promote the acquisition or designation of additional shoreline areas for public access.

Inventory of Permitted Shoreline Uses - Columbia River

SKAMANIA COUNTY

River Mile	Urban	*Rural	Conservancy	Natural	Landmarks
129.5					Skamania, Clark Co. line
129.5-131.4			X		
131.4-131.9				X	
130.3					Lower end San Is. Oregon
132.4					Cape Horn
134.9-136.4				X	Island
131.9-136.7			X		
136.7-138.7				X	
141.4					Woodward Creek
141.5-142.3				X	Pierce Island
143.5-143.1				X	Ives Island
146.1					Bonneville Dam
148.3					Bridge of the Gods
138.7-149.0			X		
149.0-151.0	X				Stevenson, Wa.
151.0-154.5			X		
154.5					Wind River
154.5-155.5					
158.2					Collins Creek
162.0					Outlet Drano Lake
155.5-163.8			X		
163.8-164.0				X	
164.0-164.8			X		
164.8-164.9				X	
164.9-165.4			X		
165.4				X	
165.6-168.3			X		
168.3					Skamania, Klickitat County line; White Salmon River

*Note: The Rural Environment is incorporated into the Conservancy Environment.

Primary Permitted Uses

Natural: Shoreline protection works and foot trails are permitted. Recreational developments shall be considered as conditional uses.

Conservancy: The permitted uses are: residences, campgrounds, public access areas, agriculture, aquaculture, forest practices operations, dredging, small boat ramp and basins, pleasure craft docks, visitor parking lots, bridges, water control devices, piling for log rafts, and shoreline protection works. The following are permitted as conditional uses: hotels, motels, condominiums, restaurants, taverns, and mining.

Public Access: Develop additional access where such intrusions will not endanger life or property, nor interfere with the rights inherent with private property.

Inventory of Permitted Shoreline Uses - Columbia River

KLICKITAT COUNTY

River Mile	Urban Industrial	Rural	Conservancy	Natural	Landmarks
168.3					Klickitat, Skamania Co. line
169.4					U.S. Hwy. 30 Bridge
168.3-169.6			X		
169.6-173.5	X				
171.1					Stanley Rock Ore. Overhead power line
175.2					Straights Point, Wa.
177.4					Major Creek
173.5-177.4			X		
177.4-178.7		X			
180.4					Klickitat River
181.0					Lyle, Wa.
178.7-186.1			X		
186.4					Power lines BPA. Rocky Island, Or.
186.1-187.1	X				
191.4					The Dalles U.S. 197 bridge
191.5					THE DALLES DAM
193.2		X			
193.2-193.7			X		
193.7-194.2				X	
195.4					Memaloose Island, Wa.
194.2-195.8			X		
197.0					Browns Island, Wa.
195.8-197.2		X			
197.2-199.9			X		
200.0					Power lines BPA
199.9-201.9	X				
203.1-205.6			X		Miller Island
200.2					SP&SS RR bridge
201.9-208.0			X		
208.0					Maryhill bridge
209.7					Maryhill Ferry
215.6					JOHN DAY DAM
208.0-215.6		X			
215.6-216.4	X				
218.0					John Day River, Ore.
223.1					J U Canyon
225.4					Sand Springs Canyon
228.5					Rock Creek
216.4-228.5			X		
236.4					Chapman Creek
242.0					Roosevelt, Wa.
228.5-243.0		X			

Inventory of Permitted Shoreline Uses - Columbia River

KLICKITAT COUNTY (continued)

River Mile	Urban Industrial	Rural	Conservancy	Natural	Landmarks
243					Wood Gulch (Creek)
243.0-244.5	X				
249.2					Pine Creek
257.7					Alder Creek
244.5-260.6			X		
260.6					Klickitat, Benton county line

Primary Permitted Uses

Natural: The permitted uses are archeological sites and historic restoration, roads, and railroads. The following are permitted as conditional uses: bulkheads, recreational uses such as access trails, shoreline protection structures, and solid waste disposal.

Conservancy: The permitted uses are: passive agriculture, sustained yield timber harvesting, archeological sites and historic restoration, marinas, boat ramps, parking, recreational and residential uses, roads and railroads. The following are permitted as conditional uses: aquaculture, bulkheads, dredging, timber harvesting not on a sustained yield, landfills, mining outdoor advertising, piers, shoreline protection structures, solid waste disposal, and utilities.

Rural: The permitted uses are: agriculture, aquaculture, and the permitted uses in Conservancy. The following are permitted as conditional uses: bulkheads, breakwaters, commercial structures, dredging, mining, outdoor advertising, piers, shoreline protection structures, and solid waste disposal.

Public Access: Opportunities for further access of the public to the Columbia River shall be fully developed.

Inventory of Permitted Shoreline Uses - Columbia River

BENTON COUNTY AND CITIES OF KENNEWICK AND RICHLAND

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
260.6					Renton, Klickitat Co. line
260.6-264.0		X			
264.0-275.3			X		
275.3-288.5		X			
290.5					Umatilla Interstate bridge
288.5-292.0	X				
292.0					McNARY DAM
292.0-317.0			X		
317.0-324.0	X				
323.4					UPRR bridge
324.0-325.3			X		
325.5					Overhead power lines BPA
325.3-328.0	X				
328.0-330.0			X		City of Kennewick
328.4					Kennewick-Pasco Hwy bridge
330.0-334.2			X		
332.9					Pipeline Crossing
334.2-342.5	X				City of Richland
335.2					Yakima River mouth
342.5-392.7		(See Note)			Federal Hanford Reservation
348.0					Site of proposed Ben Franklin Dam
380.0					Cooling water discharge from Hanford Generating Plant
382.6					Coyote Rapids
388.1					Vernita , SR 24 bridge
392.7-395.0		X			
395.0					Benton, Yakima Co. line

Note: Shoreline Management Act presently does not apply to federal lands.

Primary Permitted Uses - Benton County

Conservancy: Grain elevators, pastures, and rangelands, waterfront parks, boat ramps, piers, and docks are permitted uses.

Rural: Intensive agriculture, support activity such as pumping plants, grain elevators, docks and cargo handling facilities, and intense recreation development are permitted.

Primary Permitted Uses - City of Kennewick

Conservancy: The following are permitted: bulkheads, breakwaters, jetties, marinas, docks, piers, landfills, dredging, roads, causeways, bridges, and public utilities.

Public Access: Provision of pedestrian access and public rights-of-way along the shoreline shall be required in shoreline developments. Access will be restricted if a hazard by its very nature.

Inventory of Permitted Shoreline Uses - Columbia River

WALLA WALLA COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
309.3					Washington-Oregon State Line
309.3-311.0			X		
312.0					Port Kelley
311.0-312.3		X			
312.3-313.8			X		
314.6					Walla Walla River mouth
313.8-314.6	X				
314.6-316.6		X			
316.6-319.0	X				
319.0-323.4					McNary Wildlife Rec. Area
323.4-324.2					Burbank
324.2					Snake River; Walla Walla Franklin County Line

Primary Permitted Uses

Conservancy: Very low intensity land uses. Sustained yield activities or pasture - rangeland. Large acreages, commercial, industrial, medium to high density developments are not permitted.

Rural: Intensive agricultural, recreational and potential agricultural areas. Low density residential development.

Public Access: Subdividers should be encouraged to provide pedestrian access along the shoreline within the subdivision. Public access should be addressed as an important element when contemplating use of public shorelines.

Inventory of Permitted Shoreline Uses - Columbia River

FRANKLIN COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
324.2					Snake River, Franklin, Walla Walla County Line
324.2-324.7					State Park
324.7-328.0	X				
325.5					Overhead power lines BPA
328.0-330.0	X				City of Pasco
328.4					NP-SP&S Railroad bridge
330.0-336.0					Kennewick-Pasco Hwy bridge
332.9					Pipeline crossing
336.0-344.0		X			
344.0-351.1			X		
345.5					Pumping Plant
348.0					Site of Proposed Ben Franklin Dam
350.0-351.6					Island
350.0					Overhead power lines BPA
351.1-355.0		X			
361.7			X		Hanford Ferry
355.0-370.0			X*		USDOE Hanford Reservation
355.0-370.0					Wahluke Wildlife Rec. Area
370.0					Franklin, Grant County line

*Note: County shoreline designations do not presently apply to federal lands.

Primary Permitted Uses

Rural: Restrict intensive development along shoreline. Protect agricultural land from urban expansion, and maintain open spaces. Intensive agricultural and recreational uses are allowed. Marinas, waterfront parks, grain elevators, oil unloading facilities. Parking areas by conditional use permit. Floating breakwater, open pile works, docks, marine fueling facilities. Mining and dredging by conditional use permit. Advertising signs mounted flush to outside of buildings. Pedestrian access. Docks and launching ramps. Storm and sewage outfalls. Pumping plants. Cargo handling facilities. Landfills by conditional use permit. Piers and docks in zones. Archeological, historical preservation activities.

Conservancy: Nonpermanent, nonconsumptive activities of the physical and biological resources. Examples of permitted uses - Diffuse outdoor recreation, viewpoints, boat launching ramps, passive agriculture such as pasture, rangeland and related activities. Waterfront parks, recreation areas, boat launching facilities, docks, pedestrian access, domestic water intake plants, storm and sewage outfalls, pumping plants, grain elevators, piers and landfills require the conditional use permit. Archeological, historical restoration activities are permitted.

Natural: None permitted, except archeological historical restoration activities.

Access Requirements: Public access right of ways and improvements shall be required in large developments if the shorelines or waters are of an appropriate mature and can withstand the access.

Inventory of Permitted Shoreline Uses - Columbia River

YAKIMA COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
395.0					Yakima, Benton County line
397.0					PRIEST RAPIDS DAM
395.0-404.5			X		
404.3					Alkall Canyon
404.5					Yakima, Kittitas County line

Primary Permitted Uses

Conservancy: Maintain existing character of the area by a sustained yield, permitting timber harvesting, low density recreational activities and pasture, rangeland. Aquacultural rearing operations by conditional use permit. Except water diversions, all structures located on the land, and associated with aquacultural activities shall be at least 100 feet from any lake or stream. All forest management activities are permitted. Surface mining activities by conditional use permit. Interpretative centers, restoration of historical structures, and archeological excavations by conditional use permit. Residential activities are permitted with a minimum lot size of ten acres and a minimum shoreline frontage of 300 feet. A 100 foot setback is maintained between non-water-dependent structures and the ordinary high water mark, and no residential structure shall exceed a height of 25 feet above average grade level. Planned developments are allowed by conditional use permit. Commercial activities are permitted provided that development is of low intensity, a 100 foot setback is maintained between a structure and the ordinary high water mark. Water-dependent and water-oriented commercial uses require a conditional use permit. Low intensity recreational activities require a conditional use permit. A 100 foot setback is required between non-water dependent structures and the ordinary high water mark. Local public or private access roads to serve the permitted uses are permitted. Major highways, freeways or railways require a conditional use permit. Utility lines require a conditional use permit, shall not run parallel to the shoreline unless other routes would be economically or technically prohibitive. Power generating facilities require a conditional use permit. Industrial activities are not permitted in the conservancy environment. Bulkheads, retaining walls, dikes, levee, riprapping, jetties and grains are permitted for controlling flooding or erosion. Landfill for the purpose of developing a site for a permitted use is allowed provided no detrimental change in flood elevations, restriction of stream flow, or increase in stream flow velocities. The landfill will not cover, fill nor destroy any marsh, bog or swamp. Solid waste disposal facilities are limited to drop boxes and garbage cans. Transfer stations require a conditional use permit. Dredging, to deepen navigational channels are permitted. Houseboats and over the water residential uses excepting docks are prohibited.

Public Access: Subdivisions adjacent to publicly owned or controlled bodies of water shall allow pedestrian access from upland lots.

Inventory of Permitted Shoreline Uses - Columbia River

KITTITAS COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
404.5					Kittitas, Yakima County line
412.4					CM, SP&P Railroad bridge
404.5-411.5		X			
411.5-412.6	X				
417.0-418.0					Wanapum State Park
412.6-419.5			X		
415.8					WANAPUM DAM
418.0-423.0					Ginkgo State Park
419.5-420.5		X			
420.5					Vantage Bridge I-90
420.5-421.4	X				
421.4-432.7				X	
420.0-525.0					Indian pictograph sites
425.0-428.0					Clockum Wildlife Recreation Area
427.9					Scamon's Landing, private museum and dock
432.7-433.2			X		
433.2-447.5				X	
433.0-449.0					Clockum State Wildlife Recreation Area
441.3					Trinidad Ferry
445.0					Spanish Castle ruins
447.5					Kittitas, Chelan Co. line

Primary Permitted Uses

Natural: The following uses are permitted: agriculture, aquaculture, archeological excavations, single-family residences, and recreational trails, unimproved beaches, and primitive camp sites.

Conservancy The following uses are permitted: forest management operations, single-family residences, recreational activities, agriculture, aquaculture, low intensity commercial development, and archeological diggings and restoration. Marinas and boat launching facilities are permitted as conditional uses.

Rural: The permitted uses are: agriculture, recreational activities compatible with agriculture, single-family residences, aquaculture, archeological diggings and restoration activities, dredging for deepening a navigation channel, roads, railroads, and bridges, bulkheads, breakwaters, jetties, piers, and shoreline protection structures. Landfills and marinas are permitted as conditional uses.

Public Access: Develop a network of well planned and maintained public access areas located on publicly owned shorelines.

Inventory of Permitted Shoreline Uses - Columbia River

GRANT COUNTY

River Mile	*Suburban	Rural	Conservancy	Natural	Landmarks
370.0					Grant, Franklin County line
370.0-373.0					Wahlake Wildlife Rec. Area
373.0-391.5		(See Note)			Saddle Mountain National Wildlife Refuge
388.1					Vernita bridge SR-24
391.5-397.1					Federal Hanford Reservation
397.1					PRIEST RAPIDS DAM
397.1-402.8	X				
402.0-407.0					Priest Rapids Wildlife Recreation Area
402.8-430.0		X			
410.8					Lower Crab Creek
412.4					CM&SP&R Railroad bridge
415.8					WANAPUM DAM
420.5					Vantage Bridge I-90
430-431.2	X				
424.0-439.0					Quincy State Wildlife Recreation Area
431.2-441.0		X			
439.2-440.8					Crescent Bar Recreation Area
441.0-441.3					Trinidad
441.3					Grant, Douglas County line
596.3-597.9		X			
596.6					GRAND COULEE DAM
597.8					Grant, Lincoln Co. line

*Urban is referred to as suburban in this case.

Note: Shoreline Management Act presently does not apply to federal lands.

Primary Permitted Uses

Rural: The following are permitted uses: agriculture, single-family residences, recreational facilities (including parks, playgrounds, campgrounds, golf courses, tennis courts, swimming pools, boat launching facilities, and hunting and fishing lodges), docks and piers, aquaculture, surface mining, and breakwaters. The following are permitted as conditional uses: marinas, ports, and water-related industries, roads and railroads, utility structures, interpretive centers, and dredging and landfills.

Public Access: Plats of subdivisions adjacent to publicly owned or controlled bodies of water shall contain dedications of access.

Inventory of Permitted Shoreline Uses - Columbia River

DOUGLAS COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
441.3					Grant, Douglas Co. line
441.3-443.0		X			
441.7					Gaging Station
443.0-445.0			X		
445.0-456.0		X			
449.4					Power lines BPA
453.4					ROCK ISLAND DAM
456.0					Rock Island City Park
456.9					Burlington Northern Railroad bridge, first to cross Columbia River
456.0-459.0	X				Town of Rock Island
462.8					Douglas County Park, boat ramp
459.0-463.0		X			
464.1					Asphalt plant
463.0-465.0	X				
465.8					Sewage Treatment Plant - East Wenatchee
465.0-543.0		X			
466.3					Power line Douglas Co. PUD
473.1					Power line Chelan Co. PUD
473.5					Power lines from powerhouse
473.7					ROCKY REACH DAM
475.3-482.3		X			Orondo, Wa.
483.7					Port of Douglas Co. boat ramp & park
486.7-487.5		X			Daroga Park - Private Rec. dev.
487.7					BPA power lines
492.5					American campground/Suncove recreation & real estate development
500.4					Chelan Co. powerlines PUD
503.7					WWP powerlines crossing
504.8-505.3		X			Beebe Ranch
514.8					Powerlines Douglas Co. PUD
515.6					WELLS DAM
529.7					BPA powerlines
532.7-534.8		X			Island, Bridgeport Bar
530.0					Brewster highway bridge
533.7-535.4		X			Island near Cassimer Bar
535.8-538.5		X			Island near Bridgeport Bar
537.8-539.5		X			Chief Joseph Recreation area
539.9					Wells Wildlife Recreation Area
543.0-545.0					Bridgeport, Wa.
544.5					Bridgeport highway bridge
545.1					CHIEF JOSEPH DAM

Inventory of Permitted Shoreline Uses - Columbia River

DOUGLAS COUNTY (continued)

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
545.0-552.0		X			
551.0-590.0					Summer home development
552.0-594.0			X		
576.3-576.7			X		China Mines
597.0					Coyote Creek
586.9-587.7			X		Island, Buckley Bar
591.2					River measuring cobleway
594.0-596.3	X				
			X		Washburn Island
596.3					Grand Coulee, Wa. SR 155 bridge
596.3					Douglas, Grant Co. line
596.6					GRAND COULEE DAM

Primary Permitted Uses

Conservancy: The permitted uses include: restricted agriculture, aquaculture, single-family residences, landfills, piers and docks, archeological diggings and historical site restorations, and low intensity recreational activities.

Rural: The permitted uses in addition to those in Conservancy include: unrestricted agriculture, timber harvesting, shoreline dependent commercial development, marinas, mining, bulkheads and landfills, solid waste disposal, dredging, shoreline protection operations, roads and railroads, utilities, and recreational activities.

Public Access: Residential developers should be encouraged to provide public pedestrian access to the shoreline within the subdivision.

Inventory of Permitted Shoreline Uses - Columbia River

CHELAN COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
447.5					Chelan, Kittitas County line
449.2					Gaging station
449.4					BPA Powerline
447.5-453.2			X		
453.2-455.9		X			
453.4					ROCK ISLAND DAM
455.9-459.3			X		
456.9					Burlington Northern Railroad bridge
458.2					Alcoa Plant
459.2					Malaga, Wa.
459.3-464.9		X			
464.0					Squilchuck Creek
464.9-467.8	X				
465.1					Wenatchee Highway bridge
465.4					Aqueduct Siphon
468.4					Wenatchee River
467.8-468.4				X	
468.4-470.9		X			
470.9-472.8			X		
472.8-473.8		X			
473.1					Powerline Chelan Co. PUD
473.7					ROCKY REACH DAM
473.8-475.0			X		
474.4					Swakane Creek
475.0-477.0		X			
471.0-479.0					Swakane State Wildlife Rec. Area
476.7					SR 2 Rest Stop
477.0-478.3			X		
478.3-479.9		X			
480.8					Orondo, Wa.
479.9-483.8			X		
483.7					Entiat River
483.9					Entiat, Wa.
483.8-487.6	X				
487.7					BPA Powerlines
484.0-494.0					Entiat Wildlife Rec. Area
487.6-488.4			X		

Inventory of Permitted Shoreline Uses - Columbia River

CHELAN COUNTY (continued)

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
489.0					Pumping Station
488.4-494.9		X			
493.5					Gooseta Rock
494.9-496.2			X		
496.2-498.5		X			
500.4					Powerlines Chelan Co. PUD
498.5-501.0					Chelan Butte game range and wildlife recreation area
501.0-505.7		X			
503.0					Chelan Falls, Wa.
503.3					Chelan River
505.7-506.8			X		
506.8-510.5		X			
510.5-511-5			X		
509.2					USBR Howard Flat Wells Pumping station.
515.0					Arwell, Wa.
515.6					WELLS DAM
511.5-516.6		X			
516.6					Chelan, Okanogan Co. line

Primary Permitted Uses

Conservancy: The following uses are permitted: agriculture, aquaculture, timber harvesting, mining, multi-family and two-family residences, water-dependent commercial development, marinas, ports or water-dependent industries, shoreline works and structures, landfills, dredging, and low-intensity recreational uses.

Rural: The following uses are permitted in addition to those permitted in Conservancy: Single-family residences, archeological diggings, and medium intensity recreation. Commercial parking lots are permitted as conditional uses.

Public Access: Subdividers should be encouraged to provide pedestrian access to the shorelines within the development.

Inventory of Permitted Shoreline Uses - Columbia River

OKANOGAN COUNTY

River Mile	Urban	Rural	Suburban	Natural	Landmarks
515.6					WELLS DAM
516.6					Okanogan, Chelan Co. line
516-6-523.9		X			
523.9					Methow River
524.4					Pateros Ferry
523.9-524.5	X				Pateros, Wa.
524.9					Overhead telephone line
523.9-528.0		X			
529.7					BPA powerlines
529.7					Brewster boat ramp, dock
530.0					Brewster highway bridge
528.0-531.2			X		
533.5					Okanogan River
531.2-531.6	X				Brewster, Wa.
531.6-534.0		X			
534.0-688.0		(See Note)			Colville Indian Reservation
545.1					CHIEF JOSEPH DAM
547.2					Bridgeport State Park
596.6					GRAND COULEE DAM
604.0					Okanogan, Ferry County line

Note: Shoreline Management Act presently does not apply to Indian lands.

Primary Permitted Uses

Suburban: The permitted uses include: agriculture, diffuse commercial recreation, marinas, outdoor advertising, residential subdivisions, utilities, bulkheads, landfills, solid waste disposal, dredging, shoreline protection, roads, railroads, piers, and docks.

Rural: The permitted uses include: agriculture, forest management practices, commercial development, marinas, mining, outdoor advertising, single-family residences, utilities, water-related industry, bulkheads, landfills, dredging, shoreline protection operations, roads, railroads, piers, docks, and recreational activities.

Public Access: Pedestrian access to the waterfront shall be provided on public recreational facilities.

Inventory of Permitted Shoreline Uses - Columbia River

LINCOLN COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
597.8					Lincoln, Grant County line
597.8-638.9		(See Note)			Coulee Dam National Recreation Area (Federal land)
614.5					Keller Ferry
632.8					Lincoln, Wa.
634.0					Hawk Creek
638.9					Lincoln, Stevens County line; Spokane River

Note: Shoreline Management Act presently does not apply to federal and Indian lands.

Public Access: To provide for public physical and visual access to water.

FERRY COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
604.0					Ferry, Okanogan County line on the Colville Indian Res.
614.5					Keller Ferry
604.0-688.0		(See Note)			Colville Indian Reservation
688.0-745.0					Federal, Lake Roosevelt
706.4					Ferry, Stevens County line; Kettle River

Note: Shoreline Management Act presently does not apply to federal and Indian lands.

Public Access: Residential developers should be encouraged to provide public pedestrian access to the water.

Inventory of Permitted Shoreline Uses - Columbia River

STEVENS COUNTY

River Mile	Urban	Rural	Conservancy	Natural	Landmarks
638.9					Stevens, Lincoln County line; Spokane River
638.9-646.5					Spokane Indian Reservation
646.5-745.0					Coulee Dam National Recreation Area (federal land)
699.5					Colville River
703.2					U.S. Hwy. 395 bridge near Kettle Falls
706.4					Kettle River
745.0					U.S. - Canada Border
745.5 (British Columbia)					Pend Oreille River

Note: Stevens County Shoreline Master Program under development, not yet adopted.

NOTICE OF INTENTION TO ADOPT, AMEND, OR REPEAL RULES

(Instructions for completion on back of page)
(Additional information may be typed on back of page)

(1) Notice is hereby given in accordance with the provisions of RCW 34.04.025 and _____ that the Department of Ecology intends to adopt , amend, or repeal rules concerning
(name of agency)

Adopting chapter 173-563 WAC--INSTREAM RESOURCES PROTECTION PROGRAM -- MAIN STEM COLUMBIA RIVER IN WASHINGTON STATE.

(HEARING DATE AND PLACE)

(2) (*Use only if hearing is to be held)* that such agency will at

_____ _____ _____
(time) (day) (date)

in the _____
(place)

conduct a hearing relative thereto.

(3) and that the adoption, amendment, or repeal of such rules will take place at

1:30 p.m. Monday June 23, 1980
(time) (day) (date)

in the Lacey City Hall Council Chambers, 420 College St., Lacey, WA.

(4) The authority under which these rules are proposed is RCW 90.54.040 and 90.54.050 and chapters 90.03 and 90.22 RCW.

(5) Interested persons may submit data, views, or arguments to this agency.

(a) in writing to be reviewed by this agency prior to _____ and/or
(date)

(b) orally at _____ _____ _____
(time) (day) (date)

_____
(place)

(6) The additional notice required by RCW 34.04.025 has been made by making copies of this notice to all persons who have made timely request of this agency for advance notice of its rule making proceedings.

(7) This notice is connected to and continues the matter noticed in Notice No. WSR 80-01-113 listed with the code reviser's office on January 2, 1980 .

DEPARTMENT OF ECOLOGY
(AGENCY)

Dated April 15, 1980

By: _____
Elmer C. Vogel
Deputy Director
(TITLE)

STATE OF WASHINGTON
FILED
APR 16 1980
CODE REVISER'S OFFICE
WSR 80-05-057
NOTICE #
(Do not write in this space)

N.B. These proceedings may require additional notice pursuant to the Open Public Meetings Act of 1971, consult chapter 42.30 RCW

Washington State Department of Ecology

Chapter 173-563 WAC

INSTREAM RESOURCES PROTECTION PROGRAM--MAIN STEM COLUMBIA RIVER IN WASHINGTON STATE

Statutory Authority:	Ch. 90.54 RCW - Water Resources Act of 1971
	Ch. 90.22 RCW - Minimum Water Flows and Levels
	Ch. 90.03 RCW - Surface Water Code
Related WAC Rules:	Ch. 173-500 WAC - Water Resource Management Regulation
	Ch. 173-531 WAC - John Day/McNary Pools Water Resource Management Program

CHAPTER 173-563 WAC

INSTREAM RESOURCES PROTECTION PROGRAM FOR THE MAIN STEM COLUMBIA RIVER IN WASHINGTON STATE

NEW SECTION

WAC 173-563-010 BACKGROUND AND PURPOSE. The Columbia River is an international as well as an interstate river with its waters subject to laws of seven western states, the Province of British Columbia, Canada, and the federal governments of the United States and Canada. The flows and levels of the river are in a state of continuous change through the operation of numerous federally owned or federally licensed dams located within the river. The waters of the Columbia River are operated to support extensive irrigation development, inland navigation, municipal and industrial uses, and hydroelectric power development. Among all these uses, the anadromous fisheries of the Columbia River, which are dependent on clean flowing water, require for their survival the establishment of minimum flows of water and special actions by all agencies sharing in the management of the Columbia River.

The provisions of this chapter apply, as a matter of state law, to water right permits issued pursuant to the state's water rights code. The provisions hereof shall provide the department of ecology the basic state policy relating to minimum flows and levels for the Columbia River, for submission to various federal, interstate and state agencies having jurisdiction over the river. Further, the department of ecology of the state of Washington recognizes that, under our federal constitutional system, regulatory powers over the river are shared powers between the United States and the state of Washington and that by various federal actions the state's powers may, and in some cases, have been superseded through the mandates of the Supremacy Clause of the United States Constitution. Existing rights are not subject to the provisions of this chapter.

This chapter is adopted, under state legislative mandate, to promote the proper utilization of the water resources of the Columbia River and to protect and insure the viability of the instream resource values associated with the main stem of the Columbia River in the future through (1) the establishment of minimum flows on the main stem Columbia River in Washington State, and (2) the establishment of conservation and efficiency fundamentals relating to out-of-stream and instream uses and values.

NEW SECTION

WAC 173-563-020 APPLICABILITY. (1) This chapter applies to public surface waters of the main stem Columbia River in Washington State and to any ground water the withdrawal of which is determined by the department of ecology to have a significant and direct impact on the surface waters of the main stem Columbia River.

The extent of the "main stem" Columbia River shall be the Columbia River from the upstream extent of tidal influence (Bonneville Dam River Mile 146.1) upstream to the U.S.-Canada border (River Mile 745) and including those areas inundated by impounded waters at full pool elevations.

(2) Chapter 173-500 WAC, the general rules of the department of ecology for the implementation of the comprehensive water resources program mandated by RCW 90.54.040, applies to this chapter.

(3) Nothing in this chapter shall affect existing water rights, riparian, appropriative, or otherwise, existing on the effective date of this chapter, including existing rights relating to the operation of any navigation, hydroelectric, or water storage reservoir, or related facilities. This exemption includes all water right permits and certificates existing on the effective date of this chapter.

(4) Water right permits and certificates far domestic/municipal water supplies shall not be subject to the previsions of this chapter.

(5) The average daily flow is the average of the flows that occur over a twenty-four hour period.

NEW SECTION

WAC 173-563-030 AUTHORITY. These rules are adopted under the authority of chapter 90.54 RCW, chapter 90.22 RCW, chapter 90.03 RCW, and section 8, chapter 216, Laws of 1979 first extraordinary session, and in relation to chapter 173-500 WAC.

NEW SECTION

WAC 173-563-040 ESTABLISHMENT OF INSTREAM FLOWS. (1) In order to protect the quality of the natural environment and provide for preservation of wildlife, fish, scenic, aesthetic and other environmental values, and navigational values, minimum instantaneous flaws and minimum average daily flaws are established at the following project locations on the main stem Columbia River in Washington State:

CONTROL STATION	RIVER MILE	MANAGEMENT UNIT
The Dalles Dam	191.5	John Day Dam to Bonneville Dam (Lake Bonneville Cecilo Lake) (River Mile 146.1-215.6)
John Day Dam	215.6	John Day Dam to McNary Dam (Umatilla Lake) (River Mile 215.6-292.0)
McNary Dam	292.0	McNary Dam to Priest Rapids Dam (Lake Wallula and the Hanford Reach) (River Mile 292.0-397.1)
Priest Rapids Dam and upstream (Wanapum, Rock Island, Rocky Reach, Wells, Chief Joseph, and Grand Coulee Dam)	397.1+	Priest Rapids Dam upstream to Canadian Border (River Mile 397.1-745.0)

(2) Minimum instantaneous flows at the locations listed in WAC 173-563-040(1) are established as follows:

MINIMUM INSTANTANEOUS FLOWS - COLUMBIA RIVER PROJECTS
(1,000 cubic feet/second)

	GRAND* COULEE	CHIEF* JOSEPH	WELLS & ROCKY REACH ROCK ISLAND & WANAPUM*	PRIEST RAPIDS	MCNARY & JOHN DAY	THE DALLES
Jan		10	10	50	20	20
Feb		10	10	50	20	20
Mar		10	10	50	50	50
Apr	1-15	20	20	50	50	70
	16-25	20	30	50	70	70
	26-30	20	50	50	70	70
May		20	50	50	70	70
June	1-15	20	50	50	70	70
	16-30	10	20	50	50	50
July	1-15	10	20	50	50	50
	16-31	10	50	50	50	50
Aug		10	50	50	50	50
Sep		10	20	36	50	50
Oct	1-15	10	20	36	50	50
	16-31	10	20	50	50	50
Nov		10	10	50	50	50
Dec		10	10	50	20	20

*See following paragraph.

As provided in WAC 173-563-050(1), the minimum instantaneous flows set forth in this subsection are subject to a reduction of up to twenty-five percent during low flow years, except that in no case shall the outflow from Priest Rapids Dam be less than 36,000 cfs. For the reach from Grand Coulee through Wanapum, minimum instantaneous flows shall be as shown above, or as necessary to maintain minimum flows (subject to low runoff adjustment) at Priest Rapids, whichever is higher.

(3) Minimum average daily flows are established at the locations listed in WAC 173-563•040(1) as follows:

MINIMUM AVERAGE DAILY FLOWS - COLUMBIA RIVER PROJECTS
(1,000 cubic feet/second)

	GRAND* COULEE	CHIEF* JOSEPH	WELLS & ROCKY REACH*	ROCK ISLAND & WANAPUM*	PRIEST RAPIDS	MCNARY	JOHN DAY	THE DALLES
Jan		30	30	30	70	60	60	60
Feb		30	30	30	70	60	60	60
Mar		30	30	30	70	60	60	60
Apr	1-15	50	50	60	70	100	100	120
	16-25	60	60	60	70	150	150	160
	26-30	90	100	110	110	200	200	200
May		100	115	130	130	220	220	220
Jun	1-15	80	110	110	110	200	200	200
	16-30	60	80	80	80	120	120	120
Jul	1-15	60	80	80	80	120	120	120
	16-31	90	100	110	110	140	140	140
Aug		85	90	95	95	120	120	120
Sep		40	40	40	40	60	85	90
Oct	1-15	30	35	40	40	60	85	90
	16-31	30	35	40	70	60	85	90
Nov		30	30	30	70	60	60	60
Dec		30	30	30	70	60	60	60

*See following paragraph.

For the reach from Grand Coulee through Wanapum, minimum average daily flows shall be as shown above, or as necessary to maintain minimum flows (subject to low runoff adjustment) at Priest Rapids, whichever is higher. As provided in WAC 173-563-050(1), the minimum average daily flows set forth in this subsection are subject to a reduction of up to twenty five percent during low flow years, except that in no case shall the outflow from Priest Rapids Dam be less than 36,000 cfs.

NEW SECTION

WAC 173-563-050 CRITICAL FLOW ADJUSTMENT TO MINIMUM INSTANTANEOUS AND AVERAGE DAILY FLOWS. (1) The director of the department of ecology, when he deems it to be an overriding public interest requirement, may reduce the minimum instantaneous and/or average daily flows for the Columbia River established in WAC 173-563-040 up to twenty five percent during low flow years, except that in no case shall the outflow from Priest Rapids be less than 36,000 cfs. The amount of the reduction (from zero to twenty-five percent) shall be: (a) based on the March 1 forecast for April through September runoff at the Dallas, Oregon, as published by the National Weather Service in Water Supply Outlook for the Western United States, and (b) determined from Figure 1 in WAC 173-563-900.

(2) Prior to implementing the critical flow adjustment to minimum flows in a low water year, the department of ecology shall conduct a public hearing to announce its intentions and to solicit public and agency comment on the proposed action.

(3) The department has determined that some damage to instream values may be incurred at flow values equivalent to eighty-eight million acre-feet or less. Therefore, the reduced flows shall be referred to as critical flows and shall be authorized by the director of the department of ecology under the critical flow adjustment only when the March 1 forecast of April through September flow at The Dallas is below eighty-eight million acre-feet (MAF). The critical flows shall, in no case, provide less than 39.4 MAF (seventy-five percent of 52.5 MAF for the April through September period).

(4) All water right permits and certificates subject to this chapter shall be issued subject to the department's minimum flow requirements. (The minimum average daily flows established in WAC 173-563-040(1) and (2) are equivalent to a flow of 52.5 MAF at The Dalles for the April through September period.) All water rights subject to this flow (or its modification as established in WAC 173-563-050 during low water years) shall be regulated against on the basis of first-in-time is first-in-right.

(5) The director of the department of ecology may waive the state's minimum flow requirements delineated in WAC 173-563-040 for a defined period of time for the purpose of studying the impacts of various flow levels on the river system and its operation when such studies are to be conducted in consultation with the Washington departments of fisheries and/or game and when said exemption is requested by the departments of fisheries and/or game. Such a request shall be made by letter to the director of the department of ecology. This waiver may include the FERC studies to be conducted under Docket No. E-9569 and any operational change which does not allow the flows under WAC 173-563-040 and WAC 173-563-050(1) to be met, but which, in the opinion of the director, still provides a commensurate level of protection for instream resources.

(6) All permits and certificates issued subject to this chapter shall contain the following provision:

> This permit/certificate is subject to the minimum flow provisions contained in WAC 173-563-040 and WAC 173-563-050 and is subject to regulation by the department of ecology to insure protection of instream resources.

NEW SECTION

WAC 173-563-060 ESTABLISHMENT OF CONSERVATION AND EFFICIENCY FUNDAMENTALS. (1) The department, having determined that public water is available from the main stem of the Columbia River in Washington and that continued issuance of water right permits and certificates there from is in the public interest, does acknowledge and is concerned that, cumulatively, the projected future diversions from the main stem Columbia River in Washington state may, under certain flow conditions, have a detrimental effect on stream values.

(2) It is in the public interest that the state's water resources be conserved and that the burden of water shortages in low water years should be shared by the various users to the greatest extent practicable.

(3) Notwithstanding the constraints on prorata water-sharing under existing state water laws, the department shall, in projected low water years, utilize all reasonable measures of influence to achieve the goal of subsection (2) above.

(4) All permits issued, pursuant to chapter 90.03 RCW (or chapter 90.44 RCW, if applicable) subsequent to the effective date of this chapter, shall carry the following provision:

> Use of water under this authorization shall be contingent upon the water right holder's utilization of up-to-date water conservation practices and maintenance of efficient water delivery systems consistent with established crop requirements and facility capabilities.

(5) The department, in issuance of certificates of water rights under existing permits, or those issued subsequent to the effective date of this chapter shall, during proof of appropriation of water under RCW 90.03.330, assure that the quantities of water on the certificate accurately reflect the perfected useage consistent with up-to-date water conservation practices and water delivery system efficiencies.

(6) The department shall continue to seek effective methods to better achieve the goal of subsection (2) shove.

NEW SECTION

WAC 173-563-070 ENFORCEMENT. In .enforcement of this chapter, the department of ecology may impose such sanctions as appropriate under the authorities vested in it, including but not limited to the issuance of regulatory orders under RCW 43.27A,190 and civil penalties under RCW 43.83B.335.

NEW SECTION

WAC 173-563-080 OVERRIDING CONSIDERATIONS. Future appropriations of water which would conflict with the provisions of this chapter shall be authorized by the director only in those situations when it is clear that overriding considerations of the public interest will be served.

Such decisions shall be made in consultation with the directors of the Washington state department of fisheries and the Washington state department of game.

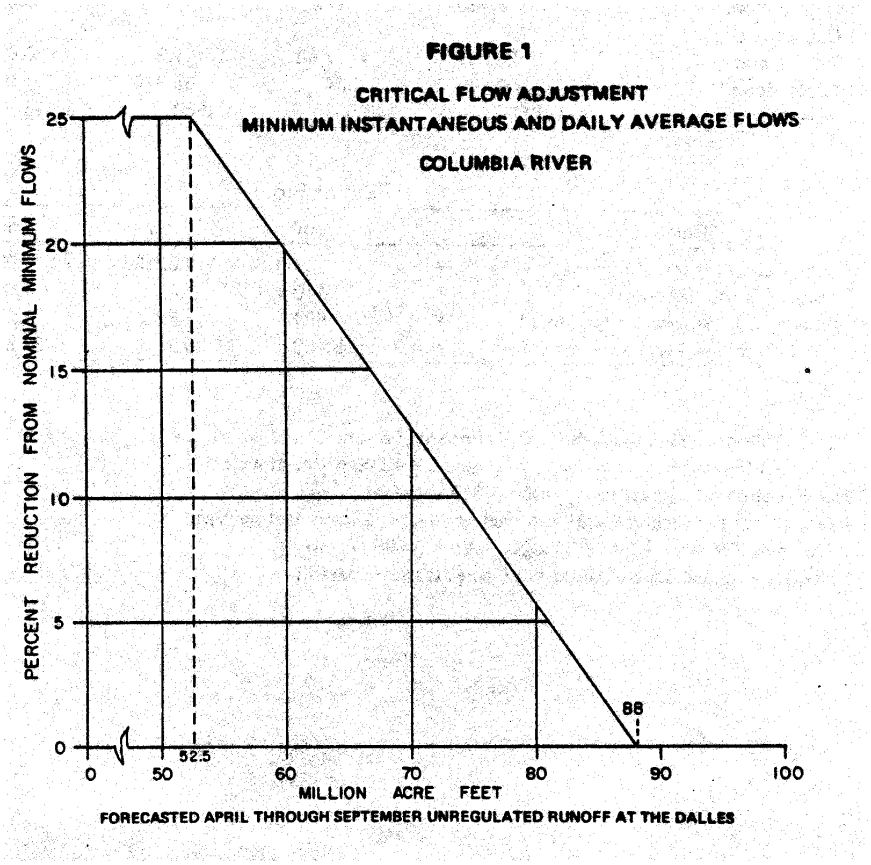
The director's consideration of the public interest shall include consideration of all uses of the river and its impact on the state of Washington. The uses to be considered include, but are not limited to, uses of water for domestic, stockwatering, industrial, commercial, agricultural, irrigation, hydroelectric power production, mining, fish and wildlife maintenance and enhancement, recreational, thermal power production, and preservation of environmental and aesthetic values and all other uses compatible with the enjoyment of the public waters of the state.

NEW SECTION

WAC 173-563-090 REGULATION REVIEW. This chapter shall be reviewed by the department of ecology at least once in every five-year period.

NEW SECTION

WAC 173-563-900 CRITICAL FLOW ADJUSTMENT-MINIMUM INSTANTANEOUS AND DAILY AVERAGE FLOWS-COLUMBIA RIVER



CONVERSION TABLES

(U. S. and Metric)

Volume

Unit		Liters	U. S. Gallons	Cubic Feet	Cubic Meters	Acre-Feet
1 Liter	=	1.0	0.264	0.035	0.001	0.00000081
1 U. S. Gallon	=	3.785	1.0	0.134	0.00379	0.00000307
1 Cubic Foot (62.4 1bs water)	=	28.317	7.48	1.0	0.0283	0.0000230
1 Cubic Meter	=	1,000	264	35.315	1.0	0.000811
1 Acre-Foot	=	1,233,500	325.851	43,560	1,233.5	1.0

Rate of Flow

Unit		gpm	cfs	mgd	cu m/sec
1 U. S. Gallon per Minute (gpm)	=	1.0	0.00223	0.00144	0.0000631
1 Cubic Foot per Second (cfs)	=	449	1.0	0.646	0.0283
1 Million U. S. Gallons per day (mgd)	=	694	1.55	1.0	0.044
1 Cubic Meter per Second (cu m/sec)	=	15,800	35.3	22.8	1.0

1 U. S. Gallon = 231 cubic inches = 0.83 Imperial Gallons
1 Liter = 1,000 cubic centimeters = 1.05 quarts = 1,000 grams of water
1 U. S. Gallon per Minute for 1 Year = 1.614 acre-feet
1 Cubic Foot per Second = 1.98 acre-feet per day = 724 acre-feet per year
1 Acre = 43,560 square feet (209 x 209 feet) = 0.405 hectare
1 Hectare = 10,000 square meters = 2.5 acres (approximately)